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TEMPERATURE-ALTITUDE

TEST REPORT

KP-I SIDE LOOKING RADAR EQUIPMENT

STATINTL

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Approved by [redacted]

ABSTRACT

This report presents the results of the temperature-altitude test conducted on the KP-I Side Looking Radar Equipment while installed in a simulated vehicle section. Results of the tests indicate that, in most cases, temperatures encountered during both normal operating and vehicle emergency conditions are not beyond system or component limitations. Temperatures measured on mock-ups of several critical components in the Antenna subsystem suggest possible problem areas during vehicle emergency conditions. Marginal reliability is indicated for these components at emergency temperatures. Recommendations are made to alleviate these marginal conditions.

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SECTION A

PHYSICAL DATA

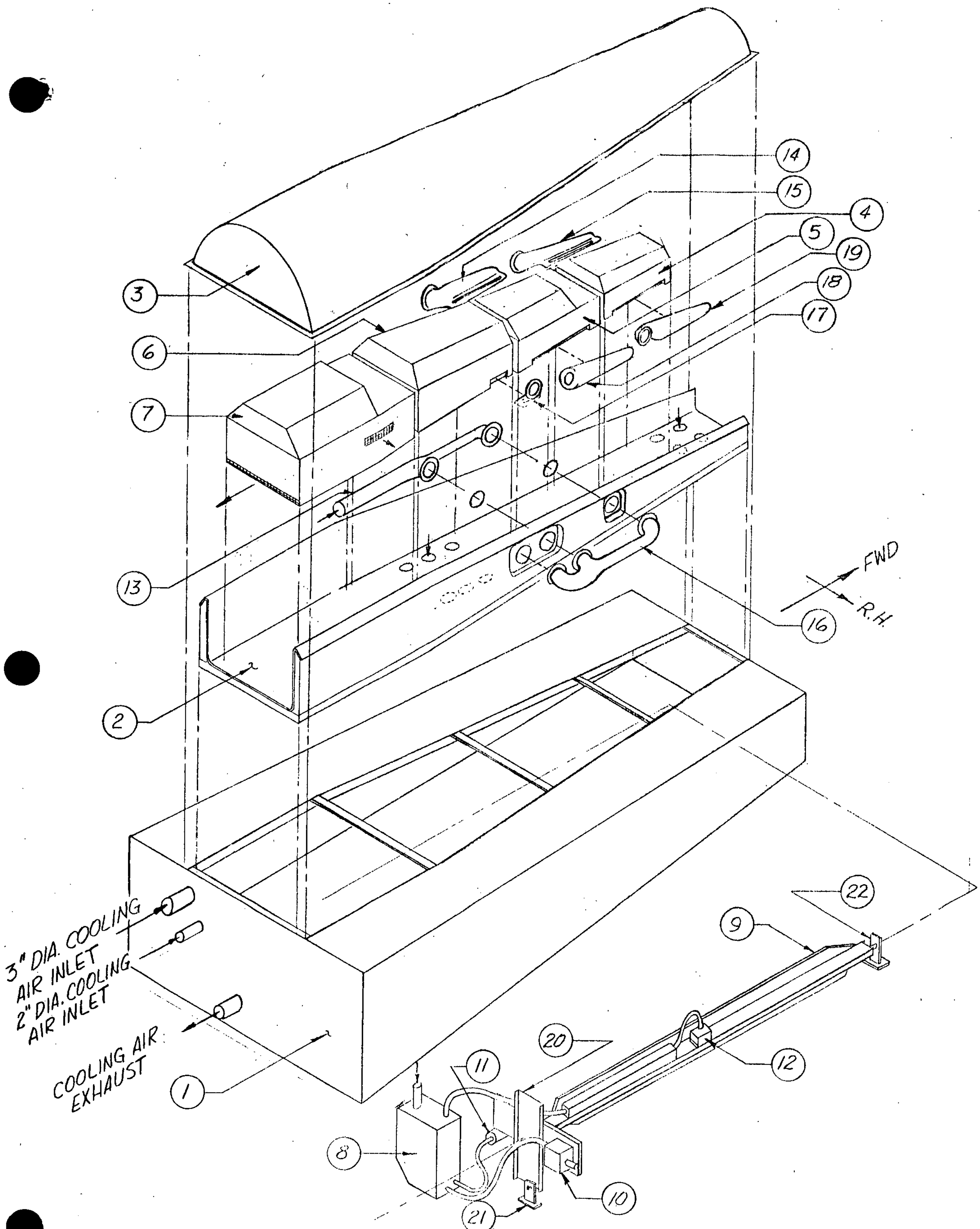
1. Purpose of Test

The purpose of this test was to determine the temperature and cooling air flow-pressure characteristics of the KP-I Side Looking Radar equipment under simulated temperature-altitude environments for various operating modes.

2. Description of Test Assembly

The KP-I radar equipment was installed in a full scale simulated vehicle section for testing. The simulated vehicle section is shown in Illustrations 1 & 2 of the Appendix. The radar equipment tested consisted of the Transmitter, Receiver, Synchronizer, Antenna Control Unit, System Junction Unit, Antenna and Antenna Subsystem (see Figure 1). A working engineering model of the Synchronizer Unit was used. Mock-ups of the various other units were tested. These mock-ups closely simulated size, shape, and internal configuration of actual units. The units were electrically wired to dissipate the following heat loads during the operating modes:

Unit Description	Heat Dissipation (Watts)
Antenna Control	120
Receiver	275
Transmitter	2700
Antenna	50
Antenna Drive	160
System Junction	50
Synchronizer Unit	40 *



TEST ASSEMBLY
FIGURE 1a

FIGURE 15

NOMENCLATURE

1. Lower Compartment Assembly
2. Support Channel
3. Dome
4. Antenna Control Unit
5. Synchronizer Unit
6. Receiver Unit
7. Transmitter
8. System Junction Box
9. Antenna Array
10. Vertical Gyroscope and Housing
11. Azimuth Gyroscope and Housing
12. Accelerometer and Housing
13. Cooling Air Manifold - Inlet
14. Cooling Air Duct - Synchronizer Inlet
15. Cooling Air Duct - Antenna Control Inlet
16. Cooling Air Manifold - Exhaust
17. Cooling Air Duct - Receiver Inlet
18. Cooling Air Duct - Synchronizer Exhaust
19. Cooling Air Duct - Antenna Control Exhaust
20. Antenna Drive
21. Antenna Support - AFT
22. Antenna Support - FWD

2. Con't

* The Synchronizer Unit was operated in the BIT mode during functional testing and dissipated approximately forty (40) watts.

Models of the vehicle cooling air ducts and manifolds (Illustrations 3 & 4 of the Appendix) were also installed in the simulated vehicle section. Air was supplied to the upper compartment through a three inch diameter inlet tube. The upper compartment air circuit consisted of a parallel air path through the Antenna Control and Synchronizer Unit (air flow equally divided) in series with the Receiver and Transmitter Units. The air flow was divided between the heat exchanger (cold plate) and the klystron collector heat sink in the Transmitter Unit. Air was then exhausted through ports in the support channel to the lower compartment.

Cooling air was introduced to the lower compartment through a two inch diameter supply line. Total flow passed through the System Junction Unit and was then divided equally between the accelerometer, the vertical gyroscope and the azimuth gyroscope.

3. Description of Test Equipment

Test apparatus were used to create, control and monitor the environments to which the equipment was subjected. Special test equipment was also used to evaluate the operation of the Synchronizer Unit under the extreme temperature-altitude conditions. A list of test equipment is given below:

Instrumentation	Type	Range	Make	Model	S/N	Calibration Expires
Manometer	W	60-inches	Meriam Inst. Co.	33Kb35	M13852	3-12-64
Manometer	W	60-inches	"	M202	H10993	3-12-64
Manometer	W	60-inches	"	M202	H10982	3-11-64
Manometer	W	34-inches	"	M103J	J30873	2-20-64
Manometer	W	34-inches	"	M103	J3087107	2-20-64
Manometer	W	130-inches	"	M103	J30872	2-20-64
Manometer	W	130-inches	"	M103	J30871	2-20-64
Brown	IC	-150 - +1000°F	Minn. Hny-well	156x12-P	940402	2-20-64
Brown	CC	-100 - +600°F	"	156x12-P	797417	2-20-64
Strip Chart	CC	-100 - +600°F	"	Y153x(67) P16-x-(106)A1	501N	2-20-64
Strip Chart	CC	-100 - +350°F	"	K153x84-C-II-III-41	R260594 0001	3-29-64
Strip Chart	IC	0 - 1200°F	"	Y153x(67) P16-x-(106)A1	5114N	3-27-64
Strip Chart	IC	0 - 1200°F	"	153x62P16-x-23	6608	3-5-64
Digital Recorder	CC	± 100 M.V.	Systron	1231	307	Calibrate Daily
Oscilloscope	585A		Tectronix		006674	
Counter	522B		GAC	L1917	EE-S118-41	3-7-64
Power Supply		0 - 50 VDC	KEPCO	SM-36-5M	C-33810	
Power Supply		0 - 50 VDC	KEPCO	SC-32-2.5	C-16137	
Power Supply			GAC	PS-171	010263	
Wattmeter		0 - 2500 W	Weston	310	16973	2-20-64
GAC Test Rack			Std. Relay			

SECTION B

TEST PROCEDURES

1. Introduction

This test procedure defines the chronological sequence of events, methods of performing the tests, and use of the test equipment.

2. Environmental Requirements

Tests were performed at reduced pressures simulating an altitude of at least 75,000 ft. and not exceeding 100,000 ft. Chamber ambient temperatures were maintained so that skin temperatures of the simulated vehicle section were stabilized at 525^{+25}_{-10} °F. Altitude and section skin temperatures were maintained even with the introduction of cooling air with various mass flow rates from 1.5 to 11.0 lbm/min.

3. Functional Test Requirements

Functional tests were conducted on the Synchronizer Unit to detect circuit malfunctions, frequency deviations and operational degradation encountered under the simulated environment. Testing consisted of a pre-test performance check, a performance check under the simulated environments and a post-test performance check. Pre-test and post-test checks were made at standard temperature and pressure. The following function parameters were measured during the performance checks:

a) PRF Trigger

b) Transmitter Trigger

3. Functional Test Requirements (Con't)

c) Range Marks

d) Sweep Trigger

e) Film Drive

f) Data Block Command

g) Motion Compensation Signals

h) Altimeter

In addition, the Synchronizer Power Supply was provided with external loads and performance checked during the temperature-altitude test. The Synchronizer Unit was externally energized during the testing.

4. Environmental Test Procedures

A) Facility - The facility consisted of a large temperature-altitude chamber with the capability of maintaining altitudes in excess of 80,000 ft. with high air mass rates (25-30 lbm/min) discharging into the chamber. High temperature capability was obtained inside an insulated enclosure within the chamber. High pressure - high temperature air was the heating medium used within the enclosure.

B) Instrumentation

1) Thermocouples - Thermocouples were used to monitor temperatures throughout the test assembly. Thermocouples were located to measure the following temperatures:

a) Cooling Air Temperatures

b) Unit Skin Temperatures

4. Environmental Test Procedures (Con't)

c) Inner and Outer Assembly Wall Temperatures

d) Component Temperatures

e) Inner Ambient Air Temperatures

The temperatures measured by these thermocouples were recorded on Brown Strip Chart Recorders and a Systron Model 1231 Digital Recorder. Thermocouple locations are given in figures 2 thru 7.

2) Static Pressure Taps - Fourteen static pressure taps were installed in the equipment to monitor cooling air flow and to determine pressure drop information through ducts and electronic units. Pressure taps were located as follows:

Tap Number	Location
P_1	3" diameter duct inlet
P_2	3" diameter duct - downstream from metering orifice
P_3	Inlet duct between Antenna Control and Synchronizer Units
P_4	Outlet duct between Antenna Control and Synchronizer Units
P_5	Transmitter inlet plenum
P_6	Ambient - adjacent to Transmitter Unit
P_7	2" diameter duct inlet
P_8	2" diameter duct - downstream from metering orifice.
P_9	5/8" dia. air supply hose (to azimuth gyro) - adjacent to System Junction Unit
P_{10}	5/8" dia. air supply hose (to vertical gyro) - adjacent to System Junction Unit

4. Environmental Test Procedures (Con't)

Tap Number	Location
P_{11}	Forward Lower Compartment - Ambient
P_{12}	Aft Lower Compartment - Ambient
P_{13}	5/8" diameter air supply hose (to accelerometer) - adjacent to System Junction Unit
P_{14}	Air duct - downstream from 3" metering section

Pressure tap locations are shown in Figure 8. Pressure measurements were made on water or mercury manometers as required. The following differential pressures were measured:

ΔP_{1-2}, ΔP_{3-4}, ΔP_{4-5}, ΔP_{5-6}, ΔP_{7-8}, ΔP_{9-12}, ΔP_{10-12}, ΔP_{13-12} and ΔP_{14-3}.

C) Cooling Air Flow Rate Measurement

1) Instrumentation - Thin plate orifice metering sections were installed by GAC and the test contractor as depicted in Figure 8. The test contractors metering sections were used to set and regulate the cooling air flow rate at the required test levels. The GAC flow sections were used to check the flow conditions set by the test contractor.

2) GAC Orifice Design and Calibration - For a square edge orifice, the fluid flow rate is proportional to the pressure drop and fluid density as given below:

$$W = KA\ (2\ \rho g\ \Delta P)^{1/2} \quad (1),$$

where W - Fluid mass flow rate

K - Velocity of approach correction factor

4. Environmental Test Procedures (Con't)

A - Area of the orifice opening

p - Fluid density

g - Gravitational constant

Δ P - Pressure drop across the orifice

To apply Eq. 1 and obtain accurate measurement of flow rate, the orifice opening must be sized so that Reynolds Number is greater than 100,000.

Since the flow rate, as given in Eq. 1, is calculated using the value of inlet density, a fluid expansion factor must be applied when measurement of altitude conditions is required. An expression for the expansion factor is,

$$Y = 1 - \left[0.41 + 0.35 (\beta)^4\right] \frac{\Delta P}{k P} \qquad (2),$$

where

Y - Expansion factor

β - Orifice to tube diameter ratio

k - Ratio of specific heats of the fluid

P - Inlet absolute pressure

Combining equations (1) and (2), the expression for compressible fluid flow through a square edge orifice is,

$$W = KAY\,(2\,pg\,\Delta P)^{1/2} \qquad (3)$$

From the above design information the following flow equations were determined for calculation of inlet cooling air supply to the test assembly.

4. Environmental Test Procedures (Con't)

Three inch diameter supply to upper compartment,

$$W_1 = 8.7\, Y \sqrt{\frac{P_1 \, \Delta P_2}{T_{IN}}} \qquad (4),$$

Two inch diameter supply to lower compartment,

$$W_2 = 8.13\, Y \sqrt{\frac{P_7 \, \Delta P_8}{T_{IN}}} \qquad (5)$$

Calibration tests using sonic nozzles (accuracy ± 2%) were performed at sea level and simulated altitude conditions. From the results it was concluded that the cooling air mass rate could be determined within seven (7) percent accuracy.

D) Set Up

The test assembly (with the KP-I Radar equipment installed) was positioned on a test stand in the insulated enclosure within the temperature-altitude chamber as shown in Figure 9.

Thermocouple leads, cable assemblies and power leads were insulated and routed through the high temperature ambient by means of insulated ducts. Thermocouple leads were connected to chamber terminal boards or routed directly through chamber ports to the recording devices. Power leads were connected to variacs outside the chamber for proper voltage adjustment. Cables (from the Synchronizer Unit) were attached to test equipment outside the chamber. Pressure taps were connected to manometers outside the chamber.

4. Environmental Test Procedures (Con't)

A three (3) inch air supply line was connected to the test assembly. A second air supply line was attached to the lower compartment air supply duct (2 inch line). A motorized regulator valve was installed on the cooling air exhaust line. A motorized control was also connected to the Transmitter damper control.

Pressure drops through the Antenna Control and Synchronizer units were adjusted so that the cooling air would divide equally between the two packages. Flow through the Transmitter Unit was adjusted for an air flow of 2.5 lbm/min. around the klystron collector and 7.0 lbm/min. through the cold plate.

E) Thermal Test Procedure

1) Pre-test Flow Data Check - Pressure tests were conducted at both sea level and altitude prior to temperature testing. Pressure information and cooling air flow data was recorded for $W_1 = 9.5$ lb/min and $W_2 = 1.5$ lb/min.

2) Warm-Up - The assembly skin temperature was raised to a temperature of $525 {}^{+25}_{-10}$ °F by introducing hot air into the chamber at a temperature not exceeding 725°F. Chamber ambient pressure was reduced to a value simulating an altitude of 80,000 - 90,000 feet. Assembly skin temperatures were maintained at $525 {}^{+25}_{-10}$ °F. Internal assembly temperatures were stabilized and maintained for 15 minutes. Cooling air was gradually introduced to maintain the temperature of the dome insulation inner wall to 120°F until

4. Environmental Test Procedures (Con't)

maximum flow was obtained (9.5 lbm/min). Pressure and temperature data was recorded.

3) Stabilization Tests

a) Run No. 1 - Stabilization, Radar Equipment Non-operating - With internal assembly temperatures stabilized as per the warm-up conditions, cooling air (W_2 = 1.50 lb/min @ 80°F) was introduced to the lower compartment. Cooling air flow to the upper compartment (W_1) was maintained at 9.5 lb/min. Internal assembly temperatures were allowed to stabilize. Pressure and temperature data were recorded throughout the stabilization period.

b) Run No. 2 - Stabilization, Radar Equipment Energized - The radar equipment was energized with internal temperatures stabilized at values obtained in Run No. 1. Cooling air flows for the upper and lower compartments were maintained at 9.5 lb/min. and 1.5 lb/min. respectively. The inlet cooling air temperature was 80°F. Functional tests were performed on the Synchronizer Unit when temperature stabilization was reached. Pressure and temperature data were recorded throughout the test period.

c) Run No. 3 - Stabilization at Emergency Conditions - Emergency operating conditions were introduced with internal temperatures stabilized as per Test Run No. 2. The radar

4. Environmental Test Procedures (Con't)

equipment was de-energized, and cooling air flow reduced to 0.75 lb/min. in both the upper and lower compartments. Cooling air temperature was held at 80°F and external skin temperatures were maintained at 525°F. Operation at these conditions continued for 15 minutes after internal assembly temperature stabilization. Pressure and temperature data were recorded throughout the test.

d) Run No. 4 - Radar Equipment Non-Operating - Cooling air flow rates were increased at the end of the stabilization period obtained in Test Run No. 3. Flow in the upper compartment was increased to 7.5 lb/min. W_2 was increased to 1.5 lb/min. Cooling air inlet temperature was maintained at 80°F, and internal assembly temperatures were allowed to stabilize. Pressure and temperature data were recorded.

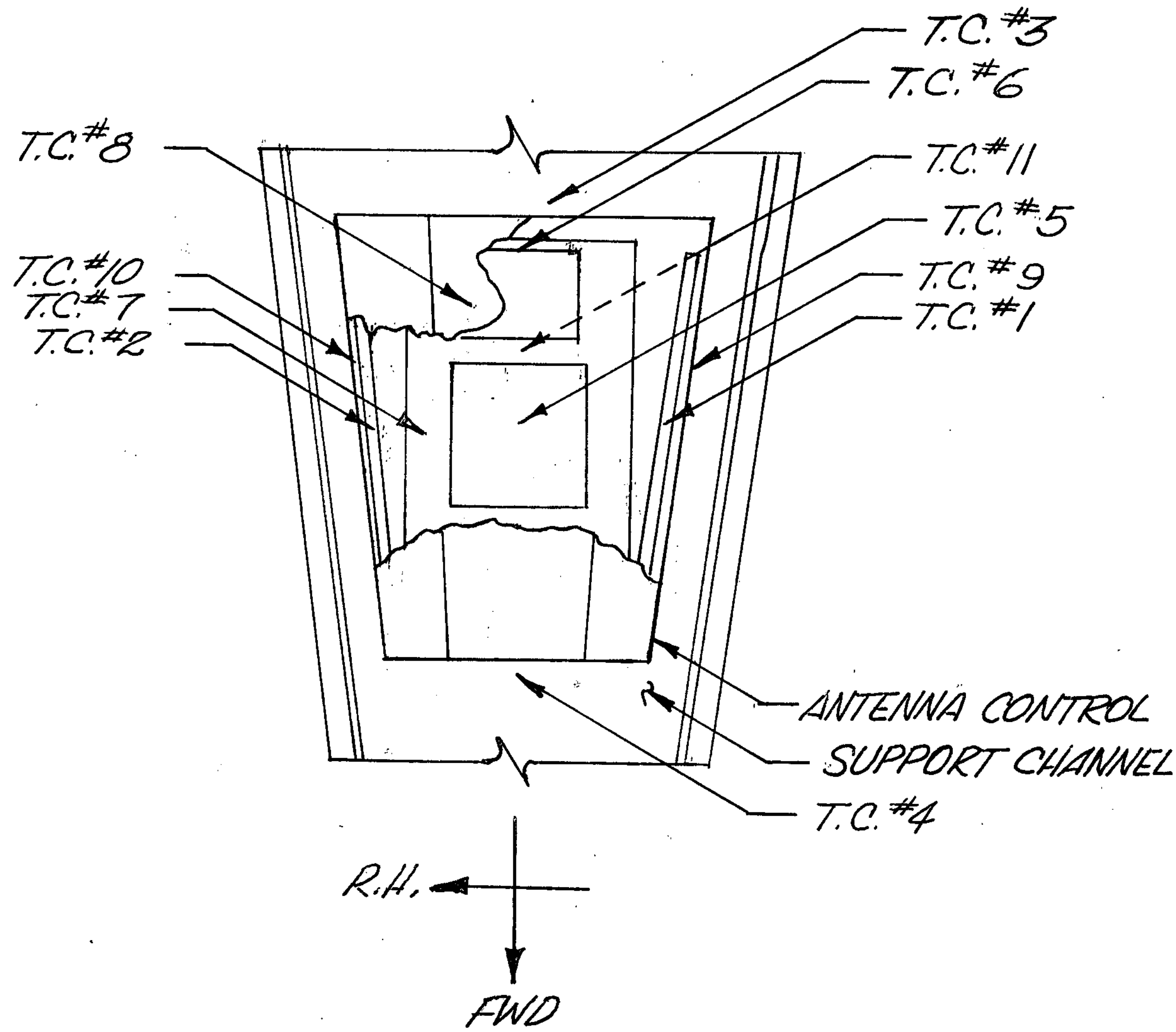
e) Run No. 5 - Radar Equipment Energized - The radar equipment was energized at the end of the stabilization period of Test Run No. 4. Cooling air flow and temperature was maintained at the values specified for Run No. 4. Operation was maintained for 15 minutes after internal assembly temperatures had stabilized. Temperature and pressure data were recorded throughout the test.

4. Environmental Test Procedures (Con't)

f) Run No. 6 - Stabilization at Emergency Conditions - The radar equipment was de-energized and cooling air flow was reduced to simulate emergency conditions. Cooling air flow rate W_1 was reduced to 0.9 lb/min. W_2 was reduced to 0.6 lb/min. Cooling air inlet temperature was 80°F. Assembly skin temperatures were maintained at 525°F. Emergency conditions were maintained until stabilization was obtained. Pressure and temperature data were recorded throughout the test period.

g) Run No. 7 - Radar Equipment Non-Operating - Cooling air flow rates were increased at the end of the stabilization period obtained in Test Run No. 6. Flow in the upper compartment (W_1) was increased to 9.0 lb/min. Flow in the lower compartment (W_2) was increased to 1.5 lb/min. The cooling air inlet temperature was 80°F. Internal temperatures were allowed to stabilize.

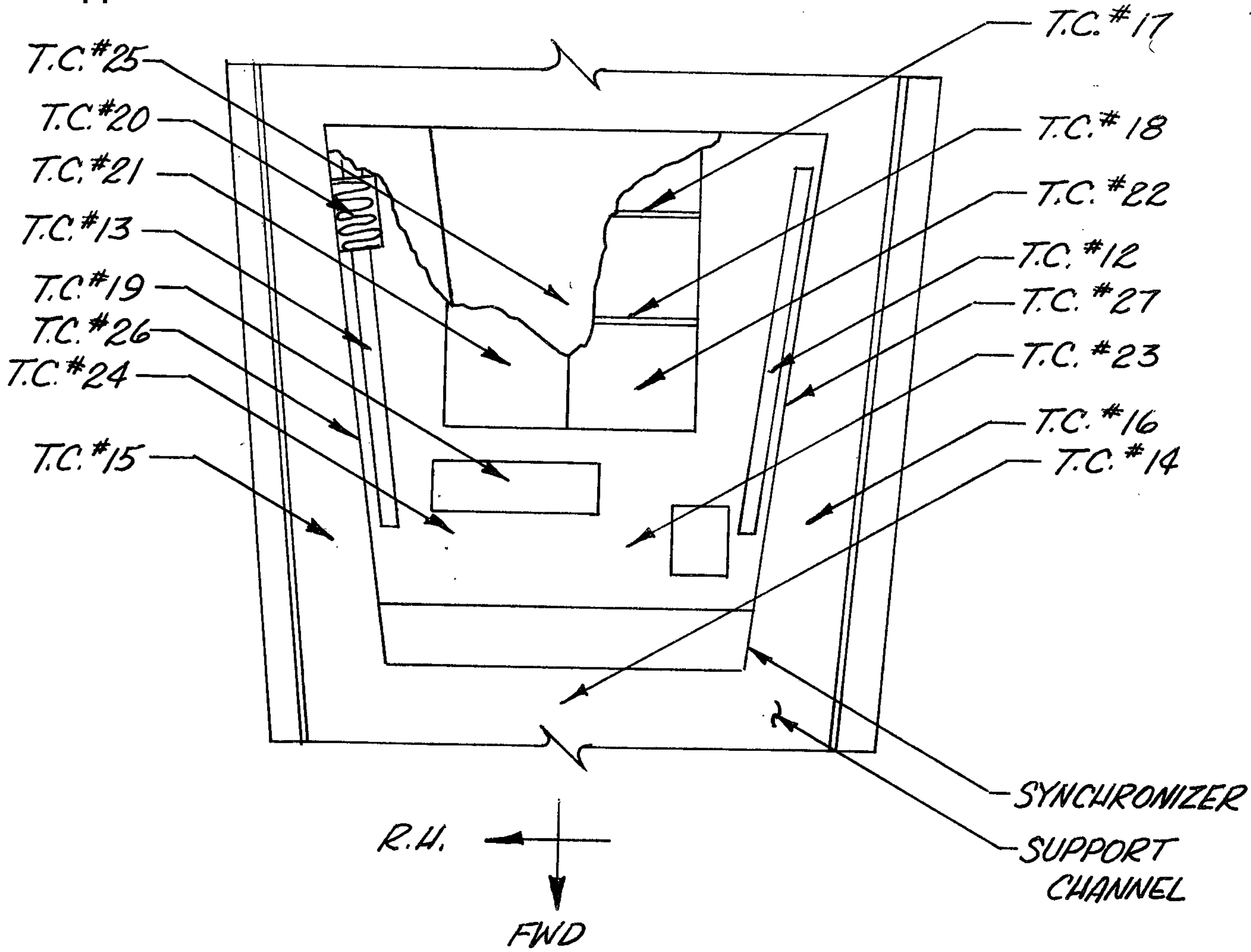
h) Run No. 8 - Radar Equipment Operating - The radar equipment was energized at the end of Test No. 7. Cooling air flow and temperature was maintained as per Test No. 7. Operation was maintained for 15 minutes after internal temperatures were stabilized. Temperature and pressure data were recorded throughout the test.



NOMENCLATURE	
T.C.#	DESCRIPTION
1	INLET COOLING AIR
2	EXHAUST COOLING AIR
3	EXTERNAL-AMBIENT
4	EXTERNAL-AMBIENT
5	INTERNAL-COMPONENT
6	INTERNAL-COMPONENT
7	INTERNAL-CHASSIS
8	EXTERNAL - TOP COVER
9	EXTERNAL - L.H. SKIN
10	EXTERNAL - R.H. SKIN
11	EXTERNAL - LOWER SKIN

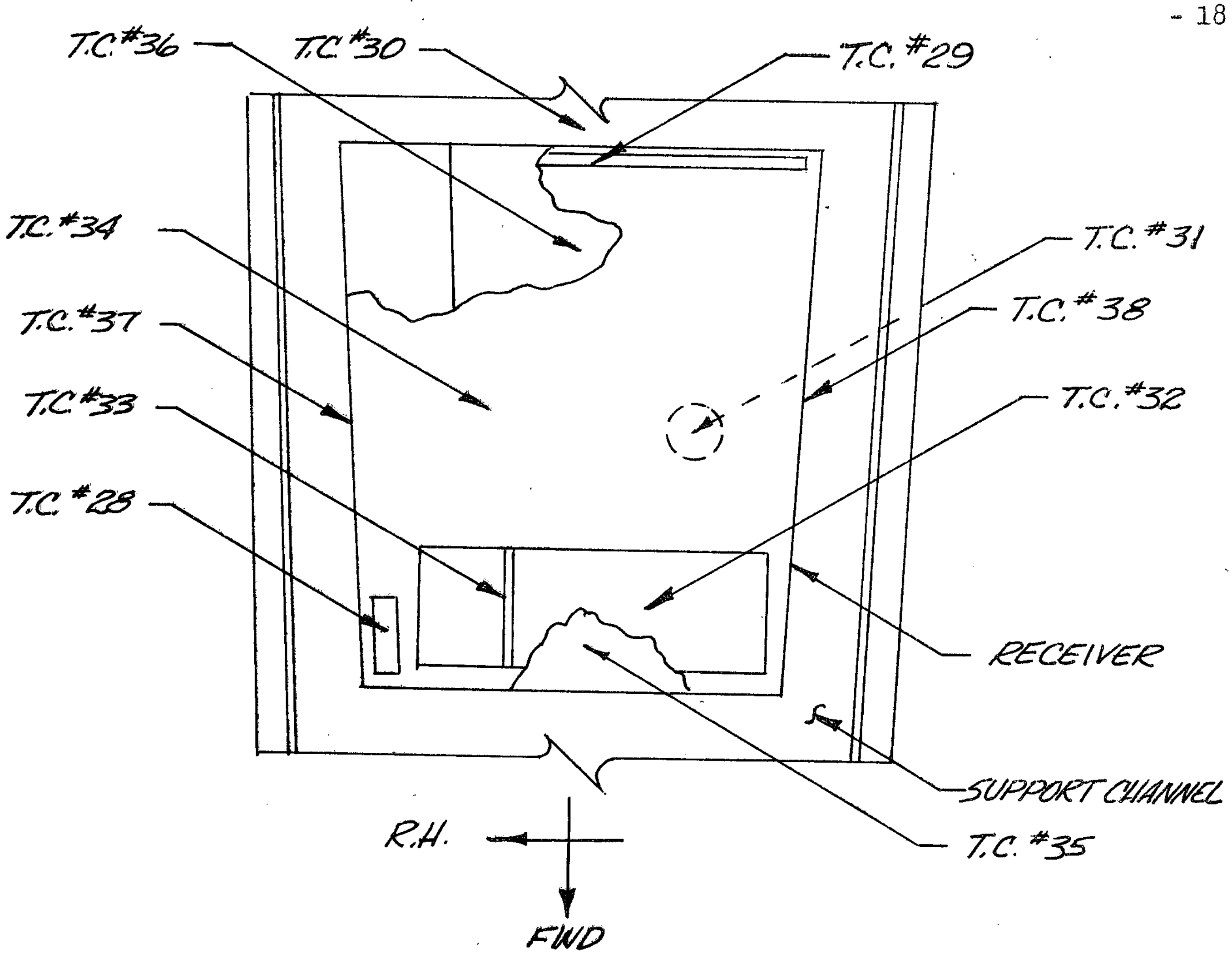
ANTENNA CONTROL – THERMOCOUPLE LOCATIONS

FIGURE 2



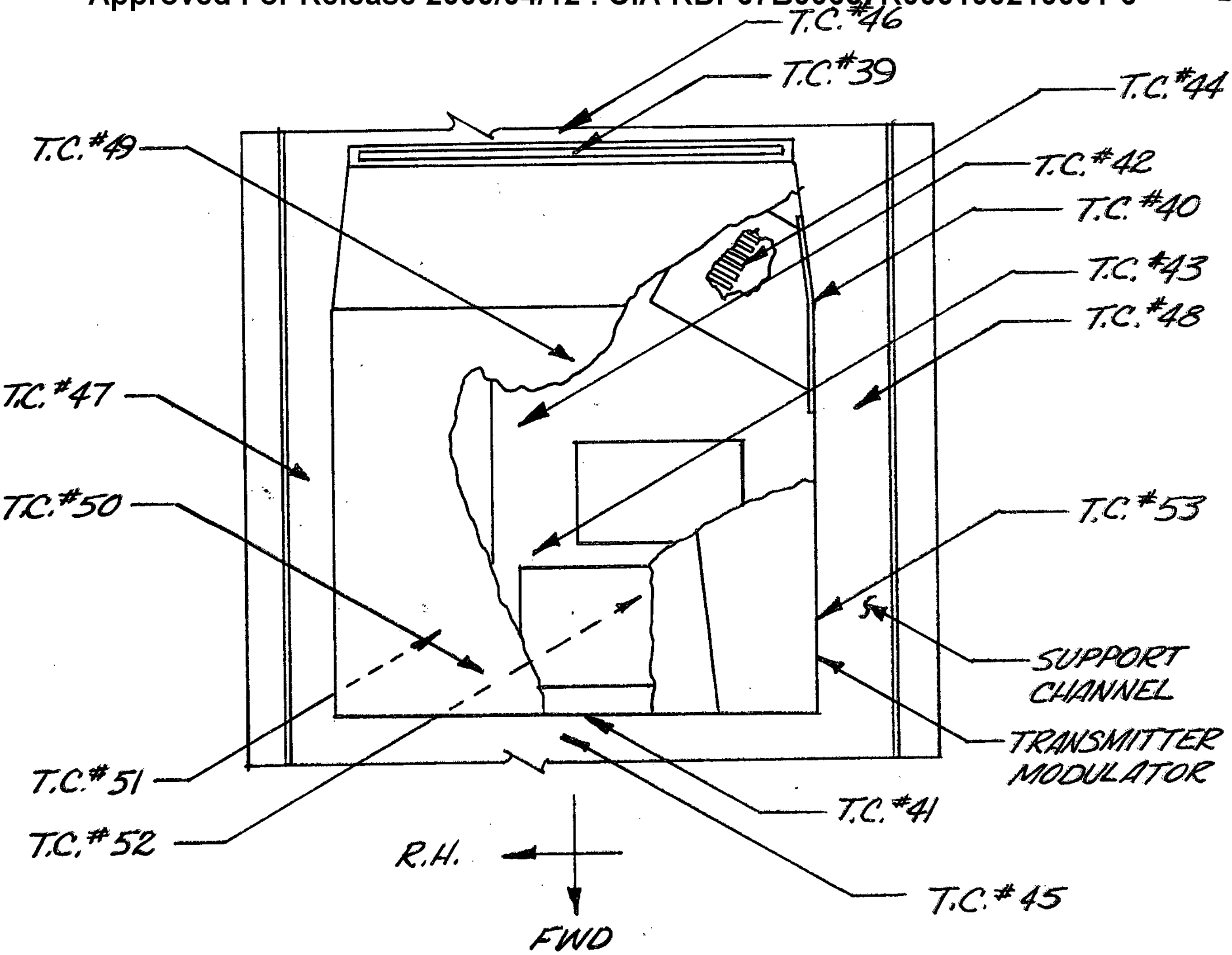
NOMENCLATURE	
T.C.#	DESCRIPTION
12	INLET COOLING AIR
13	EXHAUST COOLING AIR
14	EXTERNAL - AMBIENT
15	EXTERNAL - AMBIENT
16	EXTERNAL - AMBIENT
17	INTERNAL - P.C. BOARD
18	INTERNAL - P.C. BOARD
19	INTERNAL - POWER SUPPLY
20	INTERNAL - HEAT SINK
21	INTERNAL - BETWEEN P.C. BOARDS
22	INTERNAL - BETWEEN P.C. BOARDS
23	INTERNAL - FREE AIR
24	INTERNAL - FREE AIR
25	EXTERNAL - TOP COVER
26	EXTERNAL - R.H. SIDE
27	EXTERNAL - L.H. SIDE

SYNCHRONIZER - THERMOCOUPLE LOCATIONS
FIGURE 3



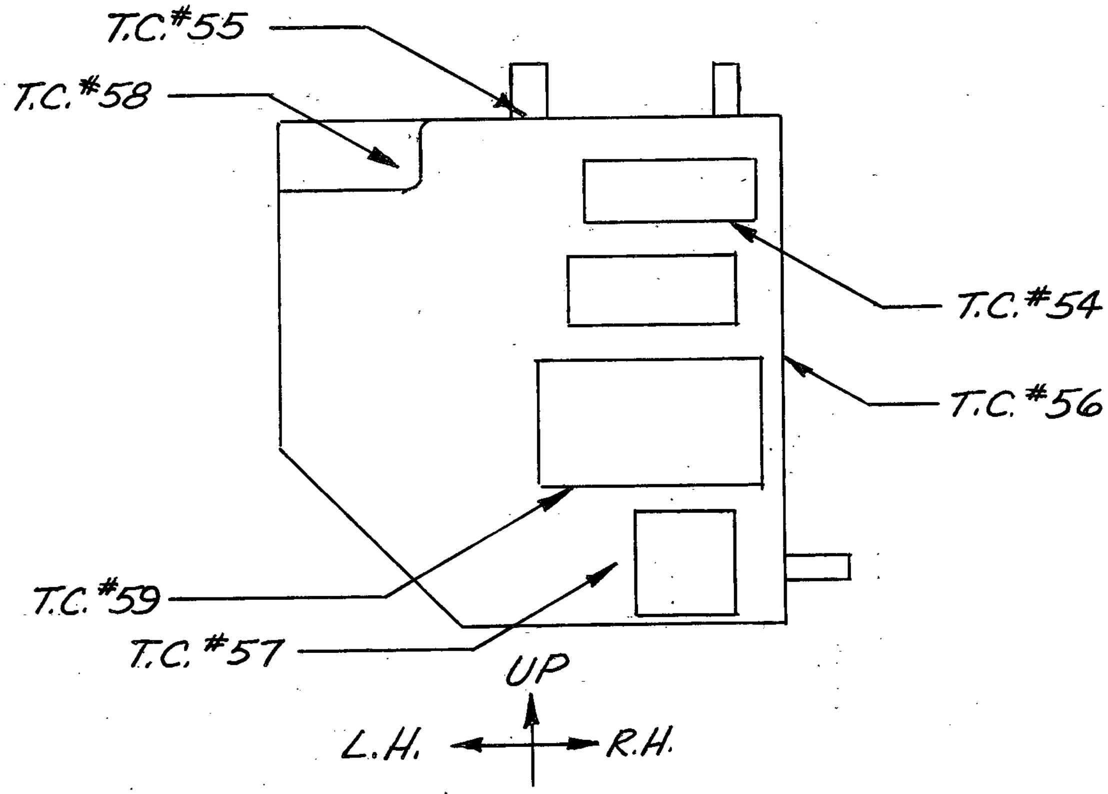
NOMENCLATURE	
T.C.#	DESCRIPTION
28	INLET COOLING AIR
29	EXHAUST COOLING AIR
30	EXTERNAL - AMBIENT
31	CHANNEL EXHAUST AIR
32	INTERNAL - BETWEEN P.C. BOARDS
33	INTERNAL - P.C. BOARD
34	INTERNAL - FREE AIR
35	EXTERNAL - TOP COVER
36	EXTERNAL - TOP COVER
37	EXTERNAL - R.H. SIDE
38	EXTERNAL - L.H. SIDE

RECEIVER - THERMOCOUPLE LOCATIONS
FIGURE 4



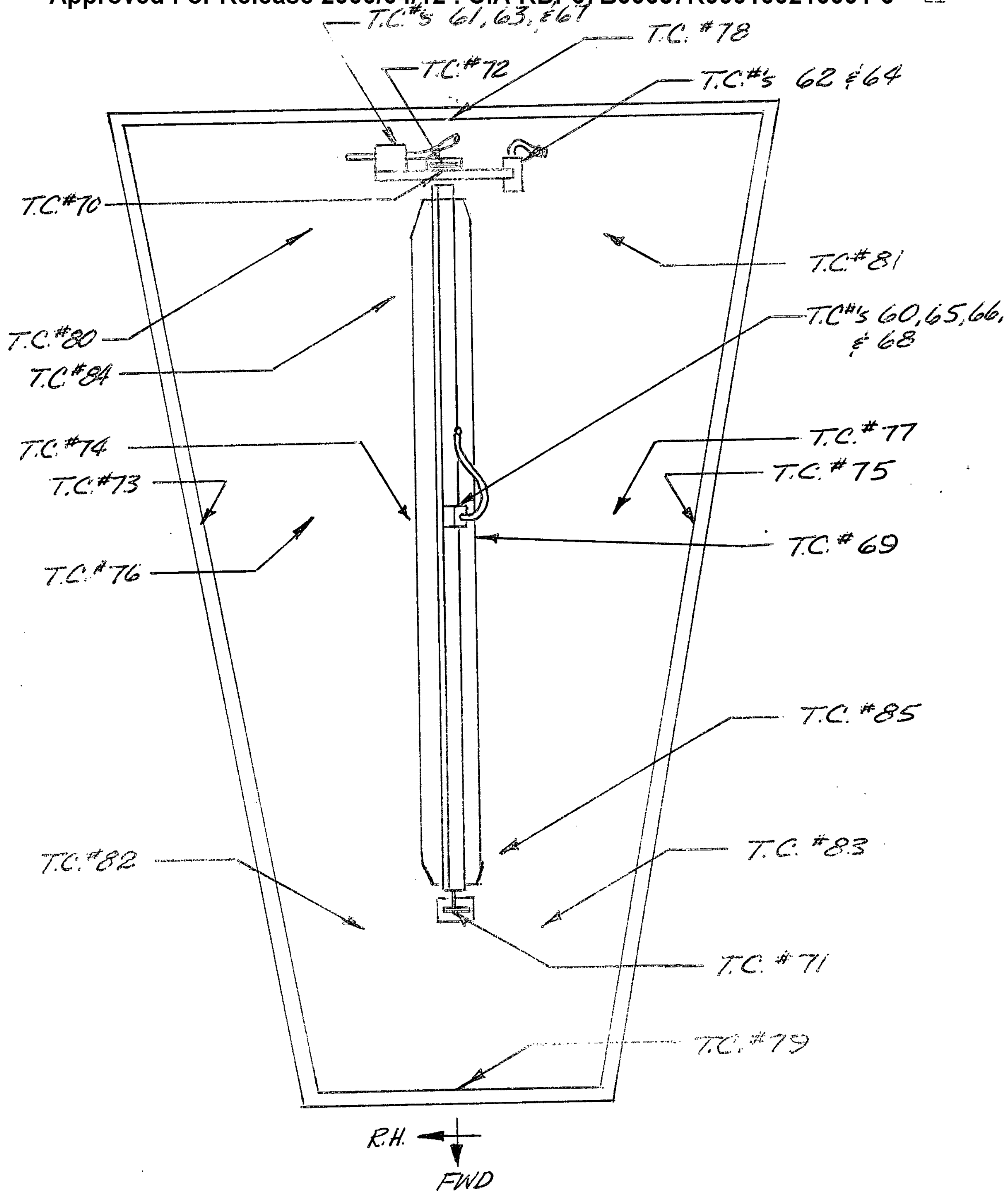
NOMENCLATURE	
T.C.#	DESCRIPTION
39	INLET COOLING AIR
40	EXHAUST COOLING AIR - COLLECTOR HEAT SINK
41	EXHAUST COOLING AIR - COLD PLATE
42	INTERNAL - COLD PLATE
43	INTERNAL - COLD PLATE
44	INTERNAL - COLLECTOR HEAT SINK
45	EXTERNAL - AMBIENT
46	EXTERNAL - AMBIENT
47	EXTERNAL - AMBIENT
48	EXTERNAL - AMBIENT
49	EXTERNAL - TOP COVER
50	EXTERNAL - TOP COVER
51	EXTERNAL - COLD PLATE
52	EXTERNAL - COLD PLATE
53	EXTERNAL - L.H. SIDE

TRANSMITTER MODULATOR - THERMOCOUPLE LOCATIONS
FIGURE 5

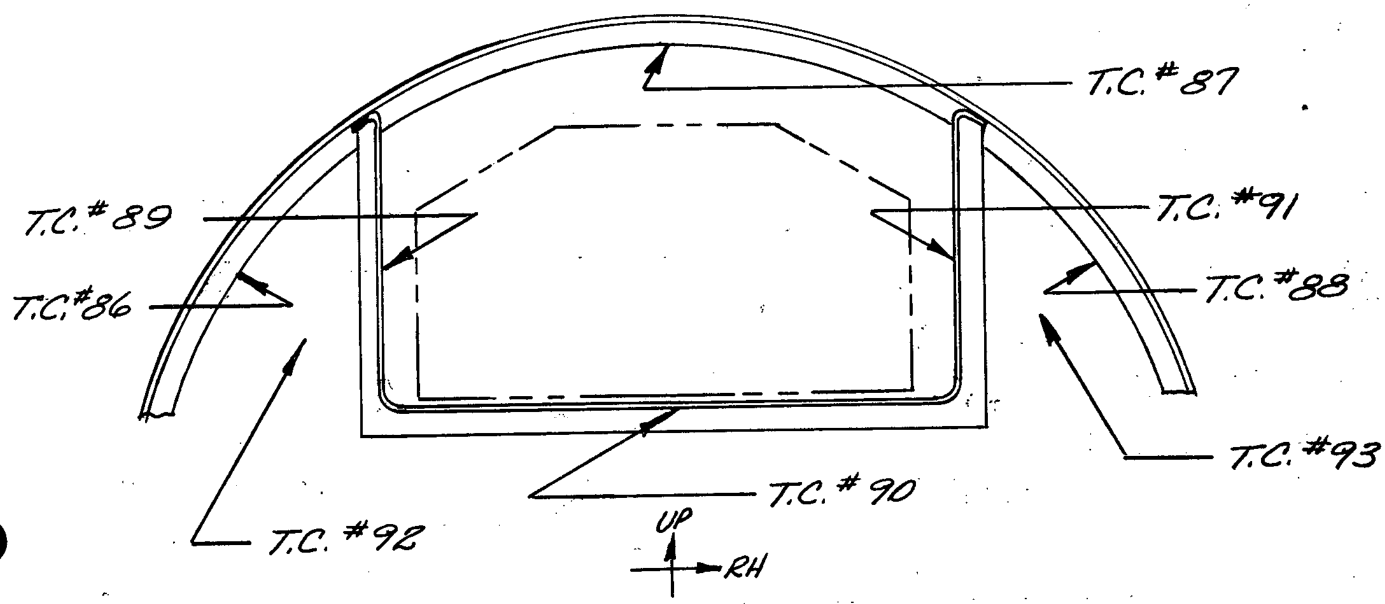


NOMENCLATURE	
T.C.#	DESCRIPTION
54	INTERNAL - COMPONENT
55	INLET COOLING AIR
56	EXTERNAL - SKIN
57	INTERNAL - FREE AIR
58	INTERNAL - FREE AIR
59	INTERNAL - COMPONENT

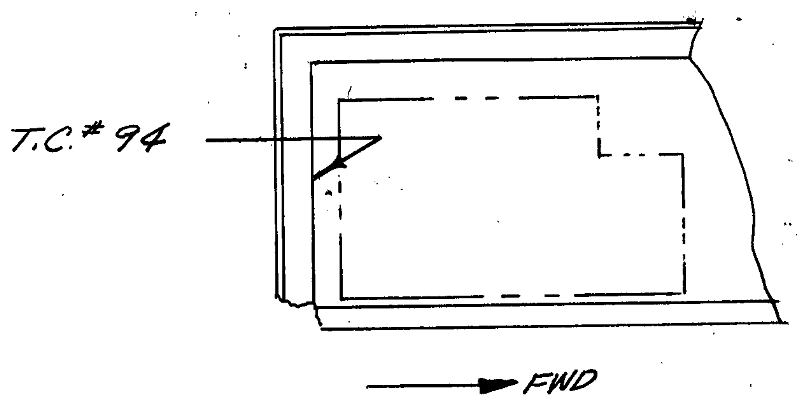
SYSTEM JUNCTION - THERMOCOUPLE LOCATIONS
FIGURE 6



LOWER COMPARTMENT - THERMOCOUPLE LOCATIONS
FIGURE 7a
(SEE FIGURE 7d FOR NOMENCLATURE)

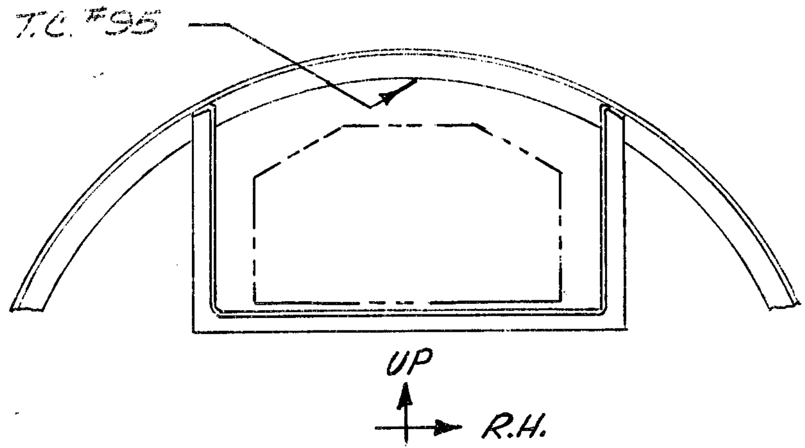


SECTION VIEW L'KG FWD
@ TRANS. MOD. UNIT

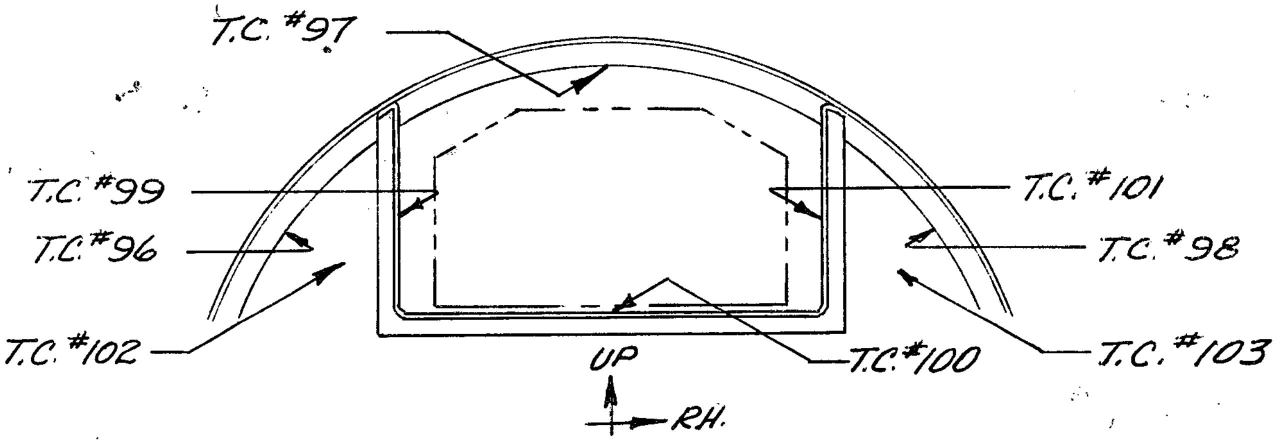


SECTION VIEW L'KG OUTB'D
@ TRANS. MOD. UNIT

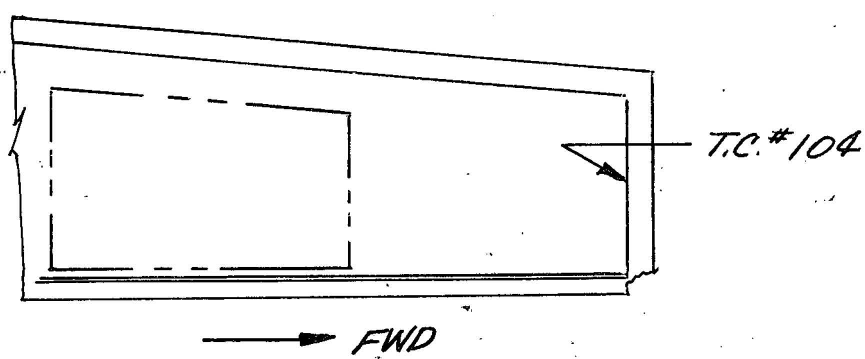
DOME AND SUPPORT CHANNEL-THERMOCOUPLE LOCATIONS
FIGURE 7b
(SEE FIGURE 7d FOR NOMENCLATURE)



SECTION VIEW LK'G FWD
@ SYNCHRONIZER UNIT



SECTION VIEW LK'G FWD
@ ANTENNA CONTROL UNIT



SECTION VIEW LK'G OUTB'D
@ ANTENNA CONTROL UNIT

DOME AND SUPPORT CHANNEL - THERMOCOUPLE LOCATIONS
FIGURE 7C
(SEE FIGURE 7d FOR NOMENCLATURE)

FIGURE 7 d

LOWER COMPARTMENT, DOME, SUPPORT CHANNEL AND MISCELLANEOUS THERMOCOUPLE NOMENCLATURE

T.C. No.	Description
60	Accelerometer Body
61	Vertical Gyroscope Body
62	Azimuth Gyroscope Body
63	Vertical Gyroscope Housing
64	Azimuth Gyroscope Housing
65	Accelerometer Housing
66	Accelerometer - Air Supply Tube
67	Vertical Gyroscope - Air Supply Tube
68	Accelerometer - Air Exhaust
69	Antenna Array
70	Antenna Drive
71	Antenna Support
72	Antenna Support
73	Lower Compartment - Insulation
74	Lower Compartment - Insulation
75	Lower Compartment - Insulation
76	Lower Compartment - Free Air
77	Lower Compartment - Free Air
78	Lower Compartment - Insulation
79	Lower Compartment - Insulation
80	Lower Compartment - Free Air

FIGURE 7 d
Con't

T.C. No.	Description
81	Lower Compartment - Free Air
82	Lower Compartment - Free Air
83	Lower Compartment - Free Air
84	Air Exhaust to Lower Compartment
85	Air Exhaust to Lower Compartment
86	Dome - Insulation
87	Dome - Insulation
88	Dome - Insulation
89	Support Channel
90	Support Channel
91	Support Channel
92	Free Air - Between Channel and Dome
93	Free Air - Between Channel and Dome
94	Dome - Insulation
95	Dome - Insulation
96	Dome - Insulation
97	Dome - Insulation
98	Dome - Insulation
99	Support Channel
100	Support Channel
101	Support Channel
102	Free Air - Between Channel and Dome
103	Free Air - Between Channel and Dome

FIGURE 7 d

Con't

T.C. No.	Description
104	Dome - Insulation
105	Inlet Manifold - Outer Skin - FWD
106	Inlet Manifold - Outer Skin - AFT
107	Exhaust Manifold - Outer Skin - FWD
108	Exhaust Manifold - Outer Skin - AFT
109	Assembly Exhaust Air

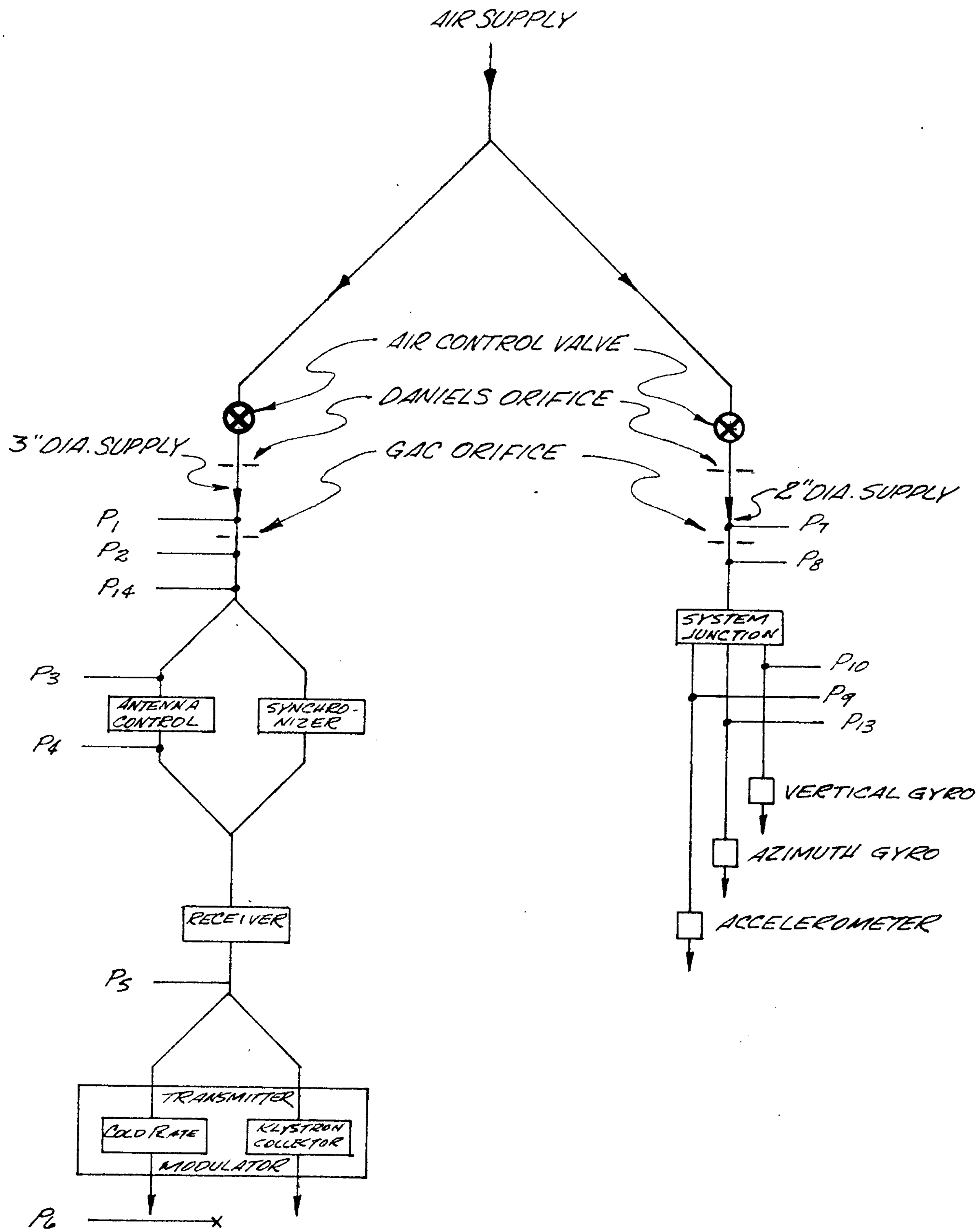


FIGURE 8a

COOLING AIR FLOW SCHEMATIC –

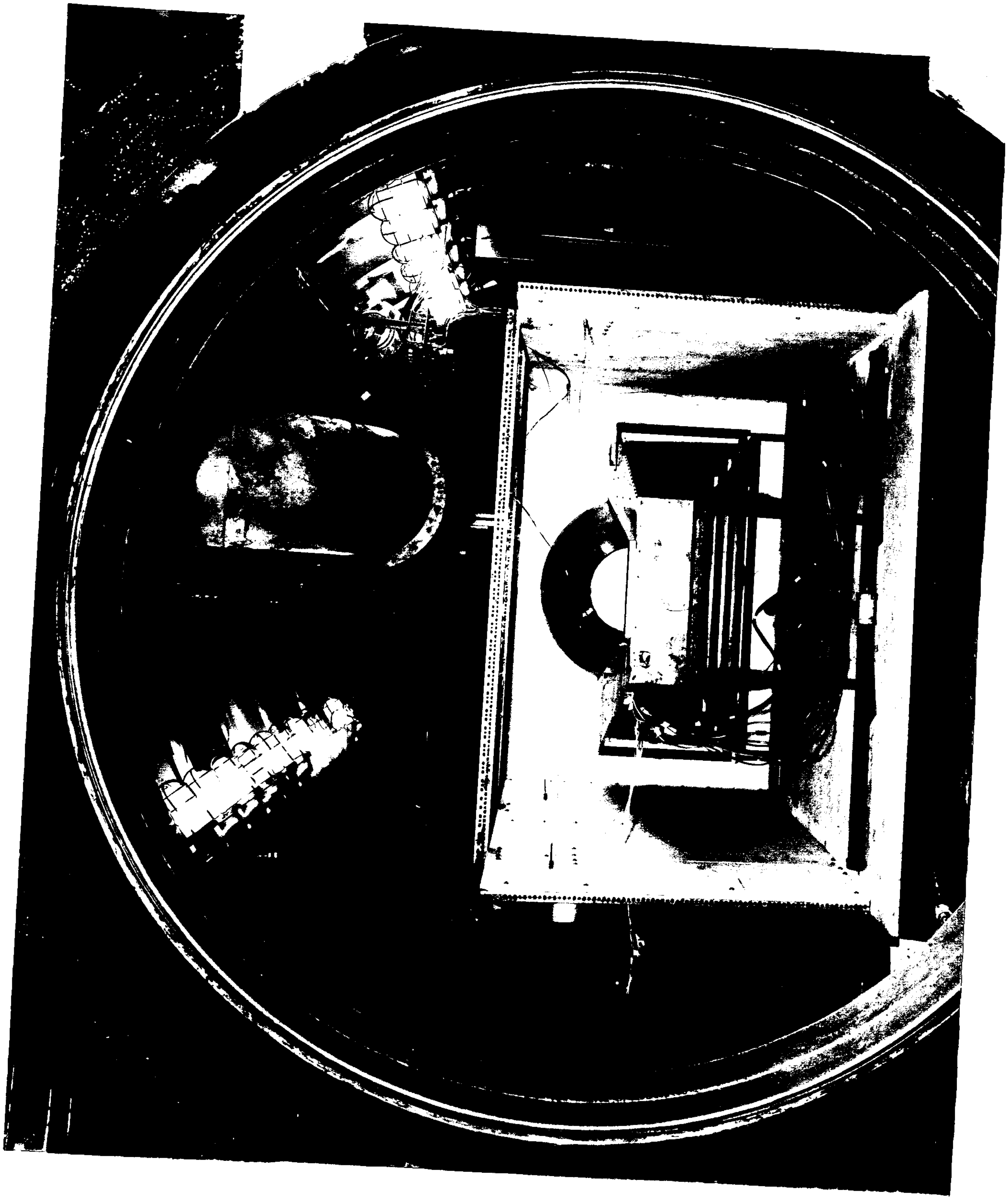


FIGURE NO. 9

Test Set-Up

SECTION C

TEST RESULTS

1. General

A. The thermal test was conducted on the KP-I Radar Equipment during period 7 January to 13 January 1964. Tests were conducted at the AiResearch Manufacturing Company. Tests were witnessed by the following:

L. L. Harmon	GAC	D/404A
H. D. Nutt	GAC	D/404A
W. M. Boley	GAC	D/451A

B. The equipment was exposed to a high temperature ambient with outer skin temperatures maintained at 525°F for approximately 50 hours. Chamber ambient pressure was reduced to simulate an altitude of 80,000 feet or better during 43 hours of this time.

C. The following tests were conducted on the radar equipment:

1. Warm-Up
2. Temperature stabilization with the radar equipment non-operating. Cooling air flow rates, W_1 and W_2, equal to 9.5 lb/min. and 1.5 lb/min. respectively (Test Run No. 1).
3. Temperature stabilization with the radar equipment operating. $W_1 = 9.5$ lb/min; $W_2 = 1.5$ lb/min. (Test Run No. 2)
4. Temperature stabilization at emergency conditions (Test Run No.3).
5. Temperature stabilization with the radar equipment non-operating. $W_1 = 6.9$ lb/min; $W_2 = 1.5$ lb/min. (Test Run No. 4).

1. General (Con't)

6. Temperature stabilization with the radar equipment operating.

   W_1 = 6.9 lb/min; W_2 = 1.5 lb/min (Test Run No. 5).

7. Temperature stabilization at emergency conditions.

   W_1 = 0.9 lb/min; W_2 = 0.6 lb/min. (Test Run No. 6).

8. Temperature stabilization with the radar equipment non-operating.

   W_1 = 7.5 lb/min; W_2 = 1.5 lb/min. (Test Run No. 7).

9. Temperature stabilization with the radar equipment operating.

   W_1 = 7.5 lb/min; W_2 = 1.5 lb/min. (Test Run No. 8).

D. Cooling Air Flow Measurement - Values of cooling air flow rates obtained from the internal monitor orifice indicate that the testing contractor maintained air flow rate within the specified tolerance for the following tests:

3" Dia. Supply Line	2" Dia. Supply Line
Warm-Up	Run No. 1
Run No. 1	Run No. 2
Run No. 2	Run No. 3
	Run No. 4
	Run No. 5
	Run No. 6
	Run No. 7
	Run No. 8

1. General (Con't)

No flow values were obtained for the three inch diameter supply line using the GAC flow section during Runs 3 and 6. Specified flow values were below the design range of the orifice.

The following flow discrepancies were observed during Runs 4, 5, 7 and 8.

Run No.	GAC Flow Section	Testing Contractor's Flow Section
4	6.9 lb/min.	7.5 lb/min.
5	6.9 lb/min.	7.5 lb/min.
7	7.5 lb/min.	9.0 lb/min.
8	7.5 lb/min.	9.0 lb/min.

The above discrepancies were noted during testing and the testing contractor was made aware of the problem. The testing contractor was unable to determine the cause of the discrepancies and the tests were continued. Subsequent investigation showed that the test facility flow values were inconsistent with air circuit pressure drops as well as with the GAC flow section measurement. Therefore, for the purpose of data analysis, GAC flow values were used. Calibration data indicate that these values are accurate within 7 percent.

2. Test Results

A. Pre-test and Warm-up - Pressure information and cooling air flow data for the pre-test flow check is given in Table 1. Pressure data recorded during and after the warm-up phase is also recorded.

TABLE Nº 1
SUMMARY OF AIR FLOW - PRESSURE DATA

RUN Nº	ALT. (FEET)	W_1 (LBM/MIN)	W_2 (LBM/MIN)	P_1 ("Hga)	$_1\Delta P_2$ ("Hg)	$_3\Delta P_4$ ("H_2O)	$_4\Delta P_5$ ("H_2O)	$_5\Delta P_6$ ("H_2O)	P_7 ("Hga)	$_7\Delta P_8$ ("H_2O)	$_9\Delta P_{12}$ ("H_2O)	$_{10}\Delta P_{12}$ ("H_2O)	P_{11} ("Hga)	P_{12} ("Hga)	$_{13}\Delta P_{12}$ ("H_2O)	P_{14} ("Hga)	$_{14}\Delta P_3$ ("H_2O)
PRE-TEST	S.L.	9.5	—	32.5	2.95	9.2	3.7	5.55	—	—	—	—	—	—	—	—	—
WARM UP	75,000	10.2	0	15.2	9.5	35.0	9.1	14.2	2.5	0	0	0	2.45	2.45	0	7.1	.2
SEA LEVEL CHECK	S.L.	9.5	—	32.6	3.0	6.9	1.2	1.62	—	—	—	—	—	—	—	—	—
1	76,000	9.5	1.5	15.3	9.6	36.1	9.65	14.7	7.35	5.3	6.0	31.0	2.25	2.70	23.3	7.2	5.7
2	75,000	9.5	1.5	15.4	9.6	35.4	8.6	18.4	7.45	5.3	6.4	33.4	2.20	2.80	25.5	7.3	5.8
3	90,000	.71	.75	1.2	5.6 △	0	1.9	1.4	4.1	2.7	12.6	18.9	.7	1.5	15.1	1.1	1.9
4	88,000	7.50	1.50	11.1	6.9	24.6	6.9	11.3	7.2	5.3	10.7	34.6	1.7	2.35	27.1	5.3	4.1
5	90,000	7.50	1.50	11.9	7.4	26.0	6.6	15.2	7.6	5.6	13.5	37.0	1.7	2.5	29.0	5.8	5.3
6.A.	75,000	0.91	0.60	2.3	10.5 △	0.95	1.50	2.2	3.1	1.8	8.3	6.6	1.35	1.6	8.9	1.9	3.25
6.B.	88,000	0.91	0.61	2.3	13.1 △	1.3	1.9	2.9	3.45	2.0	12.0	12.1	1.1	1.3	10.3	1.8	3.5
7	75,000	9.0	1.50	12.3	7.5	26.9	7.25	11.6	7.4	5.3	14.2	35.2	2.4	2.5	29.6	6.1	5.0
8	81,000	9.0	1.50	12.3	7.5	27.0	7.15	13.4	7.4	5.3	14.9	35.0	2.15	2.50	28.7	6.0	5.0

△ METERED IN INCHES OF WATER ("H_2O)

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2. Test Results (Con't)

A discrepancy in pressure data was noted at the completion of the warm-up condition. Static pressure losses across units for a particular flow were observed to be less after the assembly was subjected to temperature and altitude than before.

A change in the status of chamber availability by the test contractor made it impossible to investigate the obvious flow problems that had arisen. It was felt that the test period remaining at this point was not sufficient to undertake disassembly of the enclosure and test assembly for investigation and still perform the required stabilization tests. The test was therefore continued in order to gain as much data as possible in the remaining test time.

B. Air Flow Discrepancies - Post test investigation of the pressure discrepancy noted during the warm-up test has shown that a break had occurred in a seam of the Antenna Control Unit. This allowed cooling air loss and resulted in static pressure changes throughout the assembly.

Tests conducted at GAC have also shown that air losses of about 28% were experienced during the test runs. It was found that the percentage loss did not vary appreciably with different flow rates. Flow through the Synchronizer Unit was from 8-10% lower than specified values. Flow into the Antenna Control Unit was conversely 8-10% higher than the specified values. It was found, however, that only

2. Test Results (Con't)

50% of this air remained in the air circuit after entering the Antenna Control Unit. Measured flow values for the various units at each thest condition is given below:

Unit	Air Flow (lbm per min.)					
	Warm-Up	Run 1 and 2	Run 3	Run 4 and 5	Run 6 a and 6 b	Run 7 and 8
Antenna Control	5.54	5.17	0.38	3.79	0.48	4.07
Synchronizer	4.66	4.33	0.33	3.11	0.43	3.43
Receiver	7.33	6.83	0.50	4.95	0.65	5.40
Transmitter	7.33	6.83	0.50	4.95	0.65	5.40
System Junction	0	1.50	0.75	1.50	0.60	1.50
Accelerometer	0	0.50	0.25	0.50	0.20	0.50
Vertical Gyroscope	0	0.50	0.25	0.50	0.20	0.50
Azimuth Gyroscope	0	0.50	0.25	0.50	0.20	0.50
Leakage	2.87	2.67	.21	1.95	0.26	2.10

Pressure information and cooling air flow data for Test Runs 1 through 8 inclusive is recorded in Table A1 of Appendix. Pressure information reflects the above flow conditions. No flow discrepancies were noted in the lower compartment.

2. Test Results (Con't)

C. Test Run #1 - Stabilized temperatures with the radar equipment non-operating is given at t = 0 in Table A2 of the Appendix.

D. Test Run # 2

1. Environmental - Temperature data for all monitored points is given in Table A2 of the Appendix. Plots of the temperature histories for points of prime concern are given in Figures A1 thru A29 inclusive. These plots show the temperature response of the radar equipment from non-operating stabilized temperatures to operating stabilized temperatures with $W_1 = 9.5$ lb/min. and $W_2 = 1.5$ lb/min.

2. Functional Test - A functional test was performed on the Synchronizer Unit when temperature stabilization was reached. In general, operation was satisfactory and little degradation in performance was noted. Only two electrical problems were encountered. Temperature sensitive circuitry caused a film drive malfunction. A failure was also noted in the clutter-lock circuitry. Subsequent inspection showed this to be caused by a damaged bandpass filter. There was no degradation noted in the performance of the Synchronizer power supply during the temperature altitude testing. Electrical test data for the functional test is given in Table 2.

E. Test Run #3 - Cooling air flow problems were encountered while subjecting the test assembly to the emergency test conditions. The required flow of 0.75 lb/min. was too small for accurate measurement

TABLE 2

Test Data

KP-I Synchronizer Checkout

1. PRF TRIG

Repetition rate (measured with a Berkely counter)

	Test No. 1 Room Temperature	Test No. 2 High Alt. & Temp.
Range 1	1850 cps	1850 cps
Range 4	2233	2233
Range 5	1961	1961

Range No. 1 pulse characteristics measured with the oscilloscope. Termination 100 ohms.

	Test 1	Test 2
Tr	.055 usec	.060 usec
Tf	.160	.160
Pw	3.52	3.52
Amp	5.8	5.65

2. XMTR TRIG

Characteristics measured with oscilloscope; termination 100 ohms

	Test 1	Test 2
Tr	.075 usec	.100
Tf	.100	.100
Pw	3.4	3.4
Amp	5.65 volts	5.6 volts
Delay from PRF	11.6 usec	12 usec
Jitter	.003	.003

TABLE 2

Con't

3. RANGE MARKS

Not Available -- (Range mark test output present, but insufficient to ascertain range mark characteristics -- faulty connection)

4. SWEEP TRIGGER

	Test 1	Test 2 (High Alt. & Temp.)
Amp	5.5 volts	5.6 volts
Pw	3.5 usec	3.6 usec
Tr	.110	.100
Tf	.120	.120

Delay From PRF TRIF

Range	Test 1	Test 2
1	292.5 usec	294 usec
2	353	355
3	400	401
4	15.5	15.5
5	15.5	15.5
6	76	77.5
7	122.5	123.5
8	184.5	186
9	245.5	248
10	307	308.5
11	369.2	370

NOTE: The delay from PRF was measured with the delayed sweep control on the oscilloscope. The above deviations are due to errors in measurement since any errors in the countdown chain would have been detected in the PRF check.

TABLE 2

Con't

5. DATA BLOCK COMMAND - Termination 100 ohms

	Test 1	Test 2
Amp	5.3 volts	5.2 volts
Pw	3.1 usec	3.2 usec
Tr	.080	.100
Tf	.100	.120

6. FILM DRIVE (Sin & Cos)

	Test 1	Test 2 (High Alt. & Temp.)
Amp	8.2 volts	8 volts
Tr	15 usec	15 usec
Tf	15 usec	10 usec
Frequency	400 cps	200 cps

7. MOTION COMPENSATION

The motion compensation circuitry operated properly at room temperature, but failed to respond at the 2nd test.

8. ALTIMETER

Altitude Setting	Test 1	Test 2
10,000	0001100101	0001100101
50,000	0100011001	0100011000
75,000	0101110011	0101110011
100,000	1111110110	1111110010

2. Test Results (Con't)

by the test facility flow metering apparatus. The monitor orifice within the test assembly was used to measure and set flow. Values obtained were questionable because the orifice was not designed or calibrated for flows of this magnitude. Pressure information measured during subsequent emergency test runs indicate upper compartment flow was below required values. Flow in the lower compartment (W_2) was satisfactorily regulated by the test facility metering section.

The transistion from operating flow to emergency flow conditions made it difficult to control inlet cooling air temperatures. Inlet temperatures varied considerably during the period of stabilization. The effects of air temperature variation is noted in the temperature history curves (Figures A32 through A40 of the Appendix). Temperature data for all thermocouple locations recorded during Test Run #3 are given in Table 3 of the Appendix.

It should be noted that stabilized temperature values are higher than would be normally expected because of the uncontrolled cooling air temperature and low flow conditions complicated by the break in the Antenna Control Unit.

F. Test Run #4 - Stabilized temperature with the radar equipment non-operating is given at t = 0 in Table A4 of the Appendix. As was previously shown, W_1 = 6.9 lbm per min. and W_2 = 1.5 lbm per min.

2. Test Results (Con't)

G. Test Run #5 - Temperature data for all monitored points is given in Table A4 of the Appendix. Temperature history curves (Figures A1 through A28 and Figure A30 in the Appendix) are given for points of prime concern. These plots show the temperature response of the radar equipment beginning with non-operating stabilization to a operating stabilized condition with $W_1 = 6.9$ lb/min. ans $W_2 = 1.5$ lb/min. It should be noted that many temperature values are high as a result of the air leakage from the Antenna Control Unit.

H. Test Run #6 - Cooling air problems were again encountered while attempting to simulate emergency operating conditions. The cooling air flow rate was adequately measured and controlled by installation of an additional metering orifice in the test facility. The major problem encountered was in maintaining the cooling air at a constant temperature.

Time required for the installation of the additional orifice and the poor regulation of the cooling air temperature during stabilization made it impossible to examine the time-temperature response of the system when subjected to emergency conditions. In addition to this, it was not possible to obtain cooling air at 80°F in the 3 inch diameter supply line and in the 2 inch diameter supply line simultaneously. As a result, two stabilization tests were conducted. Temperatures were stabilized both with the inlet temperature of

2. Test Results (Con't)

the 3" supply at 80°F and with the inlet temperature of the lower compartment cooling air at 80°F. The inlet temperature of W_2 was 120°F when W_1 was maintained at 80°F; the inlet temperature of W_1 was 45°F when W_2 was maintained at 80°F. Emergency stabilized temperatures are given in Tables No. A6 and A7 of the Appendix. It should be noted that some temperatures are excessive because of the air leakage in the Antenna Control Unit.

I. Test Runs #7 & #8 - Stabilized temperatures with the radar equipment non-energized is given at t = 0 in Table A5 of the Appendix. It should be noted that the required flows for these tests were W_1 = 9.0 lb/min. and W_2 = 1.5 lb/min. As was previously shown, the air flow in the 3 inch diameter supply line was not maintained at the required level for Tests 7 and 8. For purposes of data evaluation, the GAC flow value (W_1 = 7.5 lb/min) should be used.

Curves showing time-temperature response of the radar equipment from non-operating to energized stabilization are given in the Appendix (Figures A1 through A28 and Figure A31). Temperature data for all points monitored during this test are given in Table A5 of the Appendix.

2. Test Results (Con't)

J. Synchronizer Unit, Temperature Effects - As was previously noted, two electrical failures were encountered while operating during Test Run No. 2. Post test inspection of the Unit also showed mechanical damage that occurred at some point during the test. The irridite finish on the Synchronizer Case was oxidized. Sleeving on wiring within the unit was found to have shrunk and split. Solder connections on the interconnecting cables had melted and flowed into the connector. It was also found that a bandpass filter (clutter-lock circuit) had burst from temperature and pressure effects.

SECTION D

DATA ANALYSIS

1. General

Temperature and pressure data obtained from the temperature-altitude tests performed on the radar equipment in many cases required adjustment to compensate for the air leakage from the Antenna Control.

Flow through the Antenna Control and Synchronizer Units for any particular energized run varied by less than 10% from the specified flow. Therefore, temperatures in these units are comparable to those that would have been encountered without the rupture. Temperature correction for variations in cooling air inlet temperatures was required, however, to compare data from the various test runs.

Cooling air flow through the Receiver and Transmitter Units for any particular energized run was reduced about 28% from specified values as a result of the Antenna Control rupture. Temperature data recorded for points associated with these units were therefore in excess of values that would be expected in the actual case. Pressure information for these boxes was low because of the reduced flow.

The cooling air leakage and inlet temperature problems complicated by the parallel - series air flow circuit necessitated a detailed analysis of each thermocouple temperature history for all runs in order to adjust data to required flow conditions. The analysis included:

a) Determination of test flow values at the point of concern.

b) Comparison and extrapolation of test data for the various flow and temperature conditions.

1. General (Con't)

c) Examination of the overall heat transfer coefficient for each unit at the various test conditions.

d) Comparison of cooling air temperature changes through the different units for each test run.

e) Determination and comparison of non-electrical heat loads as a function flow.

f) Determination of heat flow paths and directions as indicated by test parameters.

g) An evaluation of the compatibility of the recorded temperature information with theoretical conditions imposed by the test parameters.

2. Operating Stabilization

Data from Test Runs #2, 5 and 8 was considered in determining temperature values for cooling air flow rates of 8.5 lb/min and 1.5 lb/min. for the 3 inch diameter supply line and 2 inch diameter supply line respectively. Flow conditions for the test runs were as follows:

TEST NO.	1 & 2	4 & 5	7 & 8
Flow lb/min.	9.5	6.9	7.5
Inlet Temperature ^{o}F	79^{o}	86^{o}	70^{o}
Antenna Control Flow lb/min.	5.17	3.79	4.07
Synchronizer Flow lb/min.	4.33	3.11	3.43
Receiver & Transmitter Flow lb/min.	6.83	4.95	5.40

2. Operating Stabilization (Con't)

TEST NO.	1 & 2	4 & 5	7 & 8
Leakage Rate lb/min.	2.67	1.95	2.10
System Junction Flow lb/min.	1.5	1.5	1.5
Accelerometer Flow lb/min.	0.5	0.5	0.5
Vertical Gyroscope Flow lb/min.	0.5	0.5	0.5
Azimuth Gyroscope Flow lb/min.	0.5	0.5	0.5

This data in conjunction with tabulated data and temperature history curves was used in determining adjusted time-temperature response characteristics of the radar equipment and the test apparatus. Curves showing the temperature response of the radar equipment from non-operating stabilization to temperature stabilization in the energized condition are given in Figures 15 through 34 inclusive for $W_1 = 8.5$ lb/min. and $W_2 = 1.5$ lb/min. and assembly inlet temperature of 80^oF.

3. Non-Operating Stabilization

Stabilized values of unit and assembly temperature were determined for 8.5 and 1.5 lbm/min. cooling air flow through the three inch and two inch supply lines, respectively. Test Run No's. 1, 4 and 7 were considered at stabilized temperature conditions and at the flow conditions presented above. Temperatures determined are given at t = 0 on Figures 15 through 34 inclusive.

4. Emergency Temperature Stabilization

Data from Test Runs #3 and 6 were considered in determining adjusted emergency temperature values. Temperature data from Test Run #6 showed temperature stabilization for W_1 = 0.9 lb/min. and W_2 = 0.6 lb/min. Variations in cooling air inlet temperatures for W_1 and W_2 necessitated two stabilization periods. This resulted in a more accurate temperature survey of the test assembly. An accurate measurement of flow for Run #3 was not obtained. Pressure data taken for this run, however, indicated a flow of 0.5 lb/min. or less through the upper compartment for most of the test time. Results of Run #3 give an indication of the time-temperature response characteristics of the radar equipment under emergency conditions.

Analysis of the above data enabled formulation of emergency temperature data for an upper compartment cooling air flow rate (W_1) of 0.9 lb/min. and a lower compartment cooling air flow rate (W_2) of 0.8 lb/min. Curves showing the temperature response of the radar equipment from operating stabilized conditions to temperature stabilization during vehicle emergency conditions are given in Figures 35 through 59.

5. Pressure Information

Pressure data recorded for the various flow conditions required adjustment to compensate for air leakage at the Antenna Control Unit rupture. Values measured for ΔP_{14-3}, ΔP_{3-4}, ΔP_{4-5}, and ΔP_{5-6} (see Figure 8) are erroneous for any particular flow because of the air circuit change which resulted from the box rupture. The pressure loss from point 14 to point 3 was slightly higher because of an increase

5. Pressure Information (con't)

in flow to the Antenna Control Unit. Pressure loss through the Antenna Control is given by ΔP_{3-4}. This loss is considerably less than would normally be expected because of the air leakage. Pressure differentials, ΔP_{4-5} and ΔP_{5-6}, are indicators of flow through the Receiver and Transmitter Units respectively. These pressure differences were approximately 50% of values expected for full flow since flow losses amounted to nearly 30%.

Adjustment of pressure information for an upper compartment flow of 8.5 lb/min. required examination of the test flow data as well as post-test sea level flow checks made with the Antenna Control Unit repaired. Sea level pressure values were adjusted to altitude conditions by considering average air densities at the points of interest for the operating mode. Pressure differences at altitude are equal to the product of the fluid density ratio (sea level to altitude) and the sea level pressure difference.

$$\Delta P_{alt} = \frac{P_{SL}}{P_{Alt}} \Delta P_{SL}$$

Values found for a flow of 8.5 lb/min. are as follows:

$$\Delta P_{14-3} = 5.0'' \; H_2O$$

$$\Delta P_{3-4} = 28.8'' \; H_2O$$

$$\Delta P_{4-5} = 16.4'' \; H_2O$$

$$\Delta P_{5-6} = 35.9'' \; H_2O$$

It should be noted that ΔP_{5-6} is based upon 75% of total flow through the Transmitter heat exchanger (cold plate).

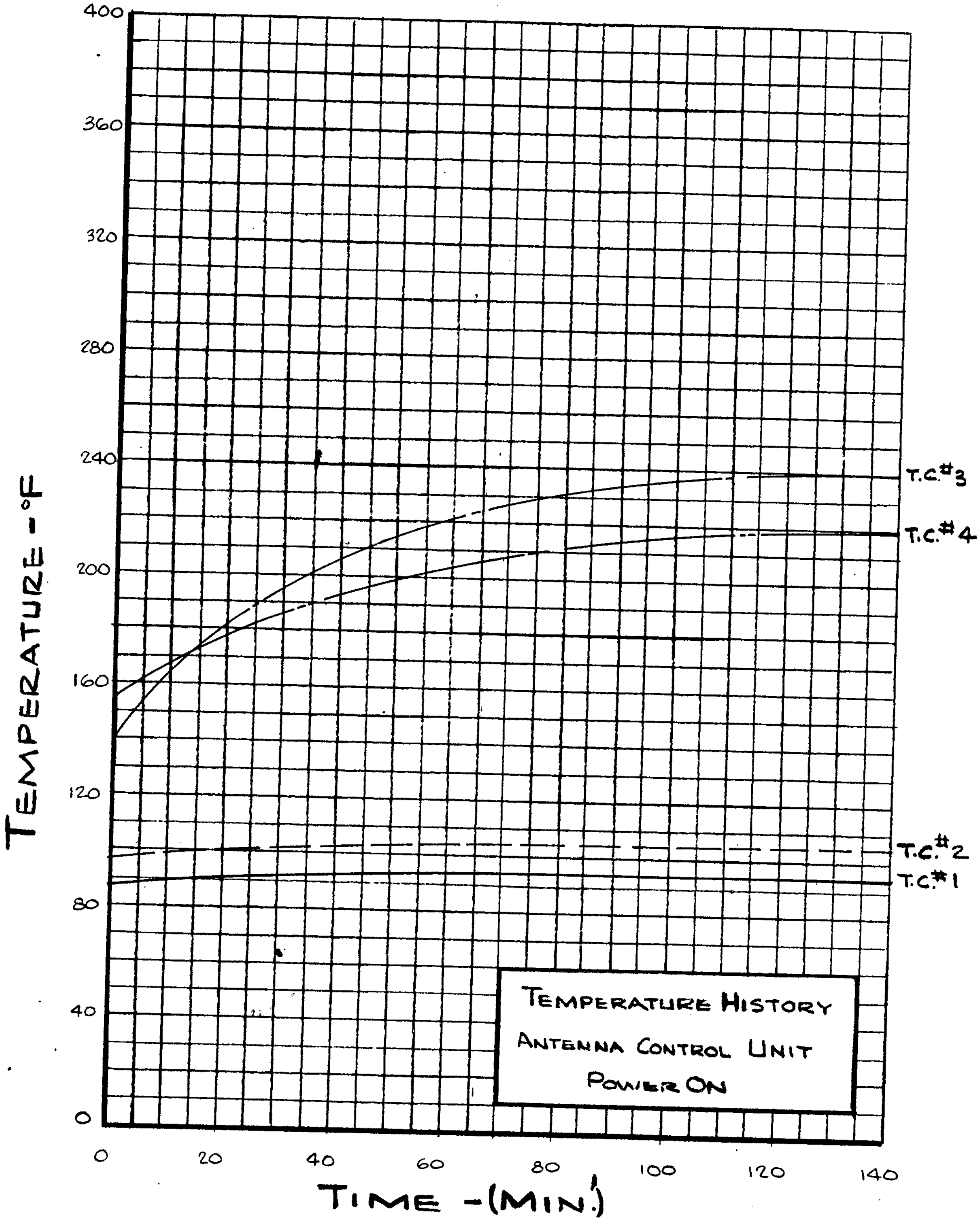

FIGURE Nº 10
(T.C. LOCATIONS FIG. Nº 2)

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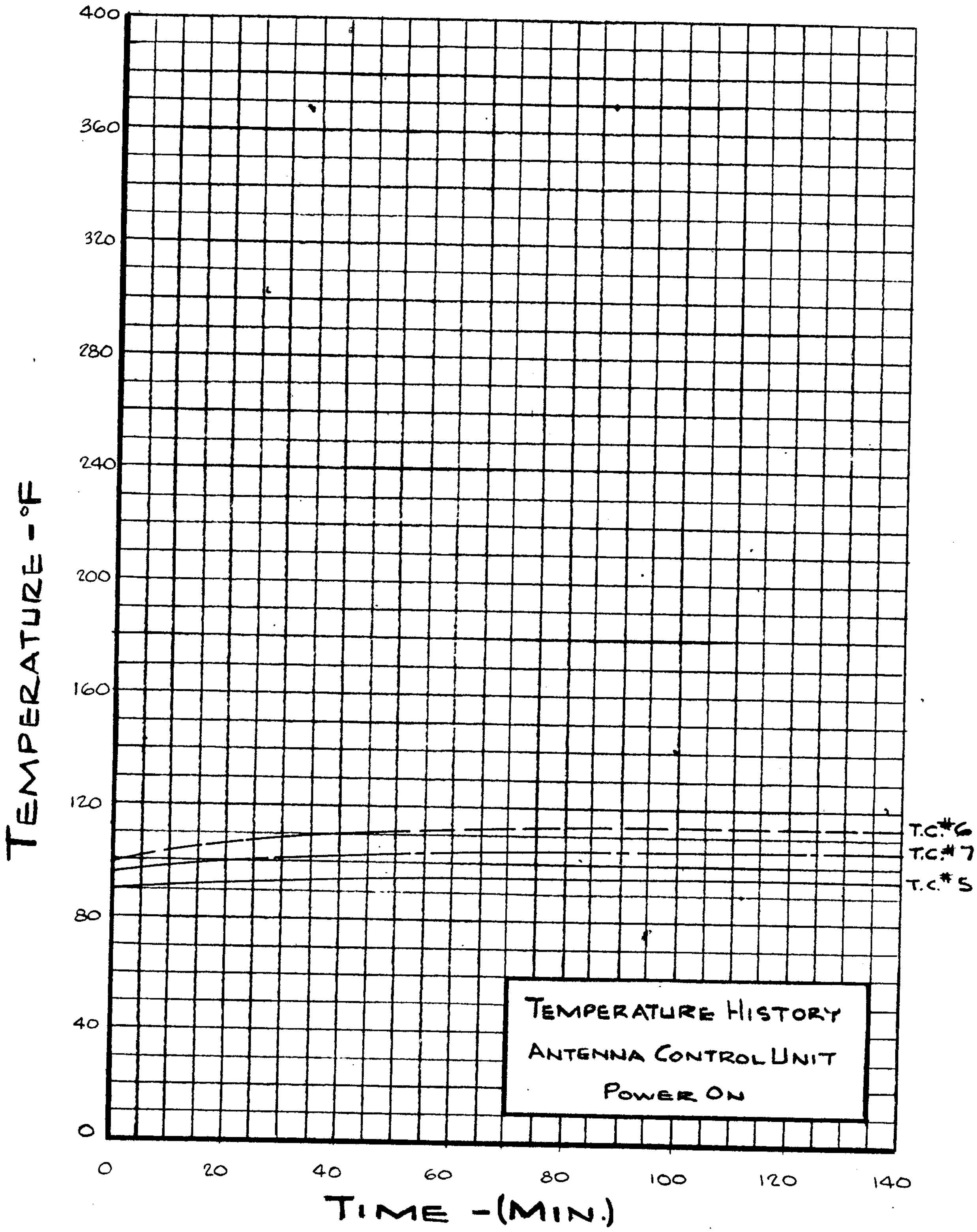

FIGURE Nº 11
(T.C. LOCATIONS FIG. Nº 2)

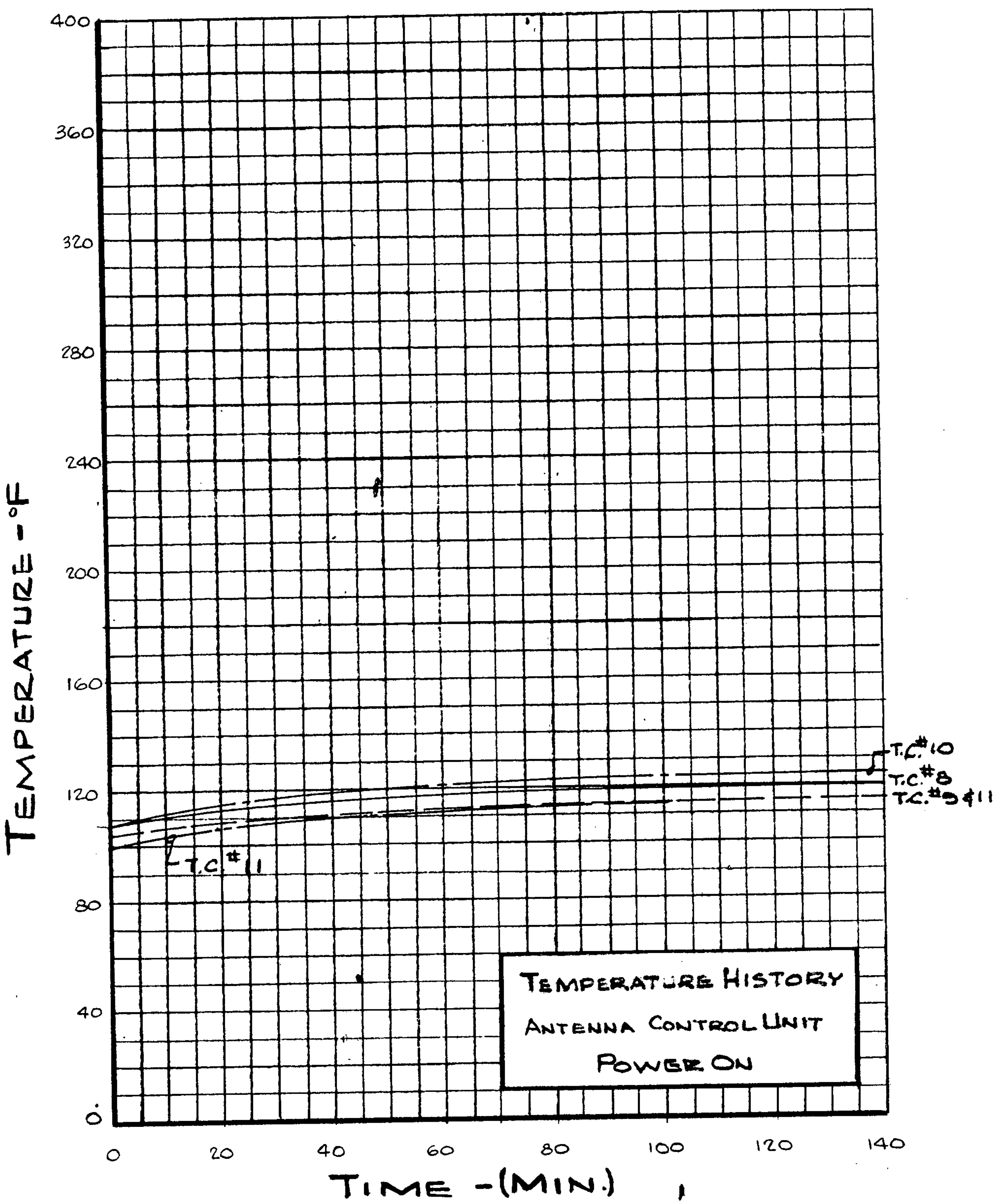

FIGURE Nº 12
(T.C. LOCATIONS FIG. Nº 2)

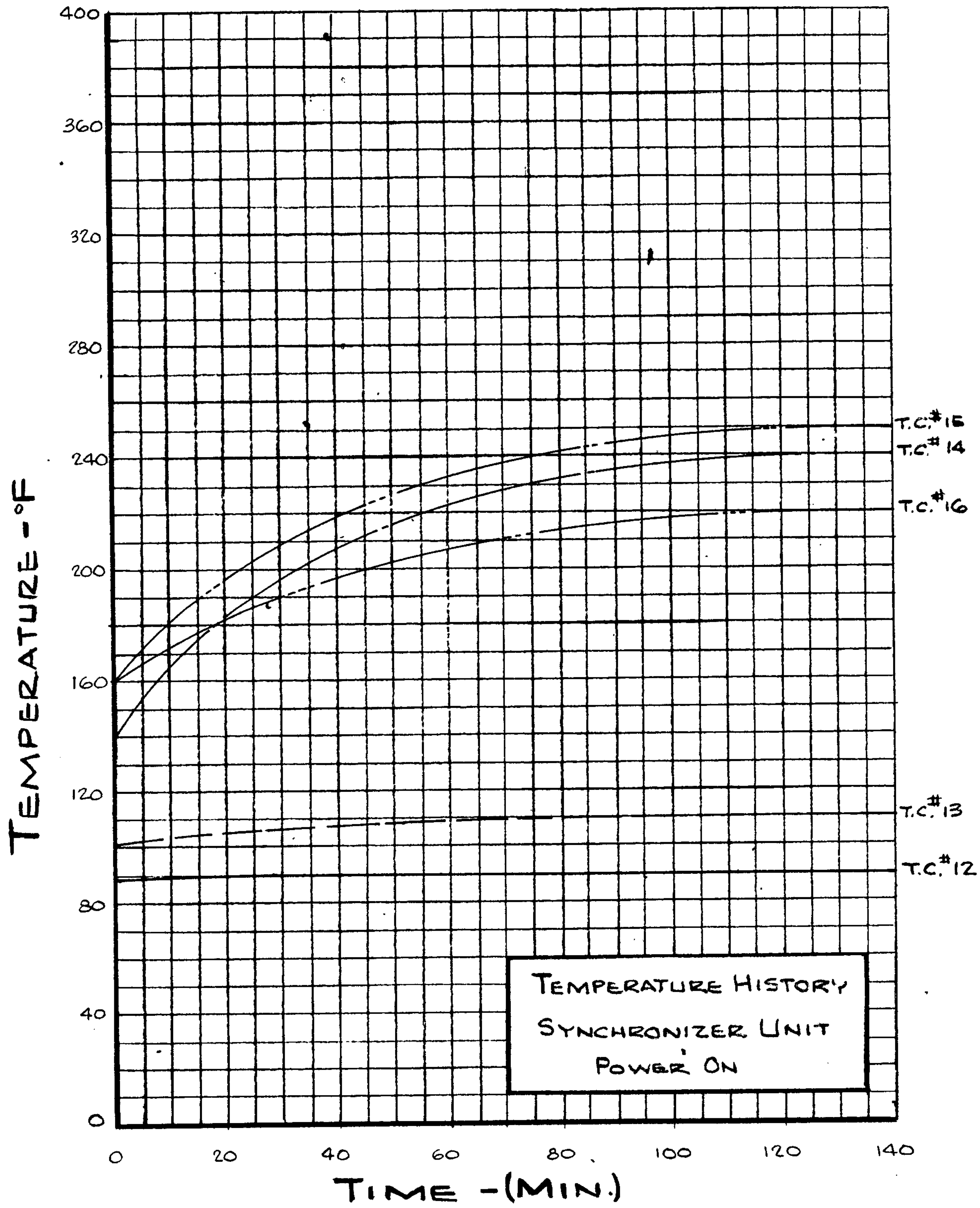

FIGURE Nº 13
(T.C. LOCATIONS FIG. Nº 3)

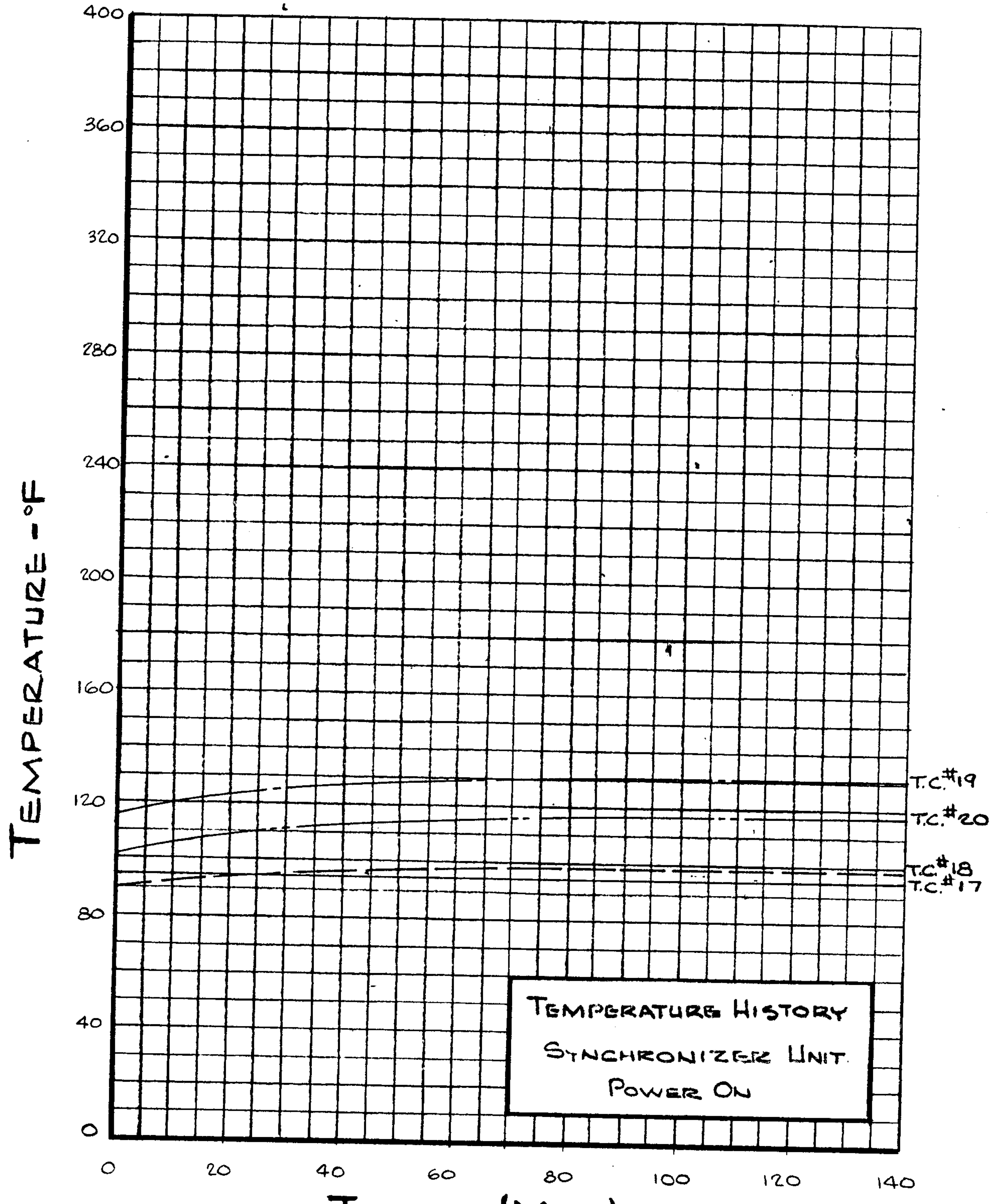

FIGURE Nº 14
(T.C. LOCATIONS FIG. Nº 3)

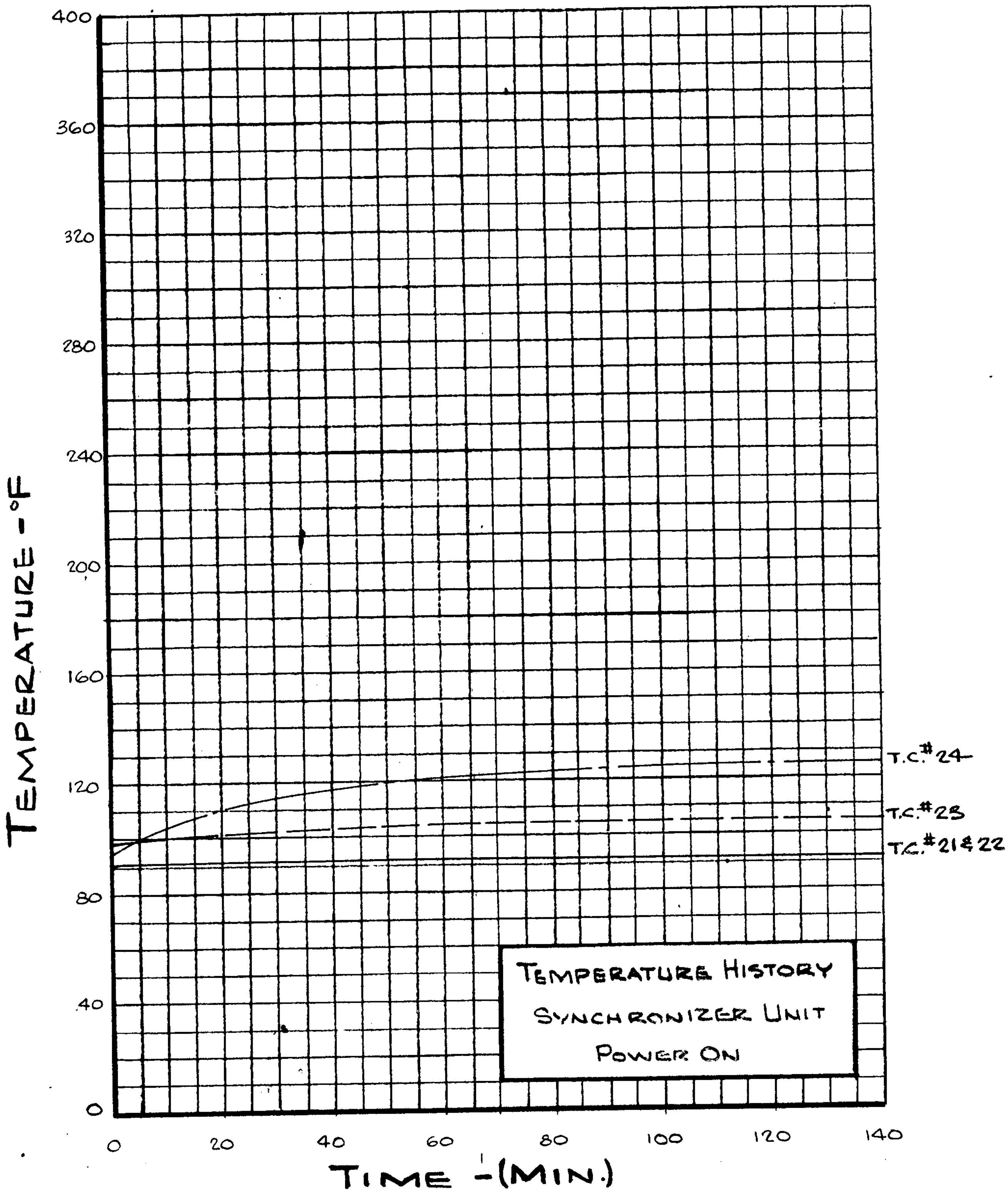

FIGURE Nº 15
(T.C. LOCATIONS FIG. Nº 3)

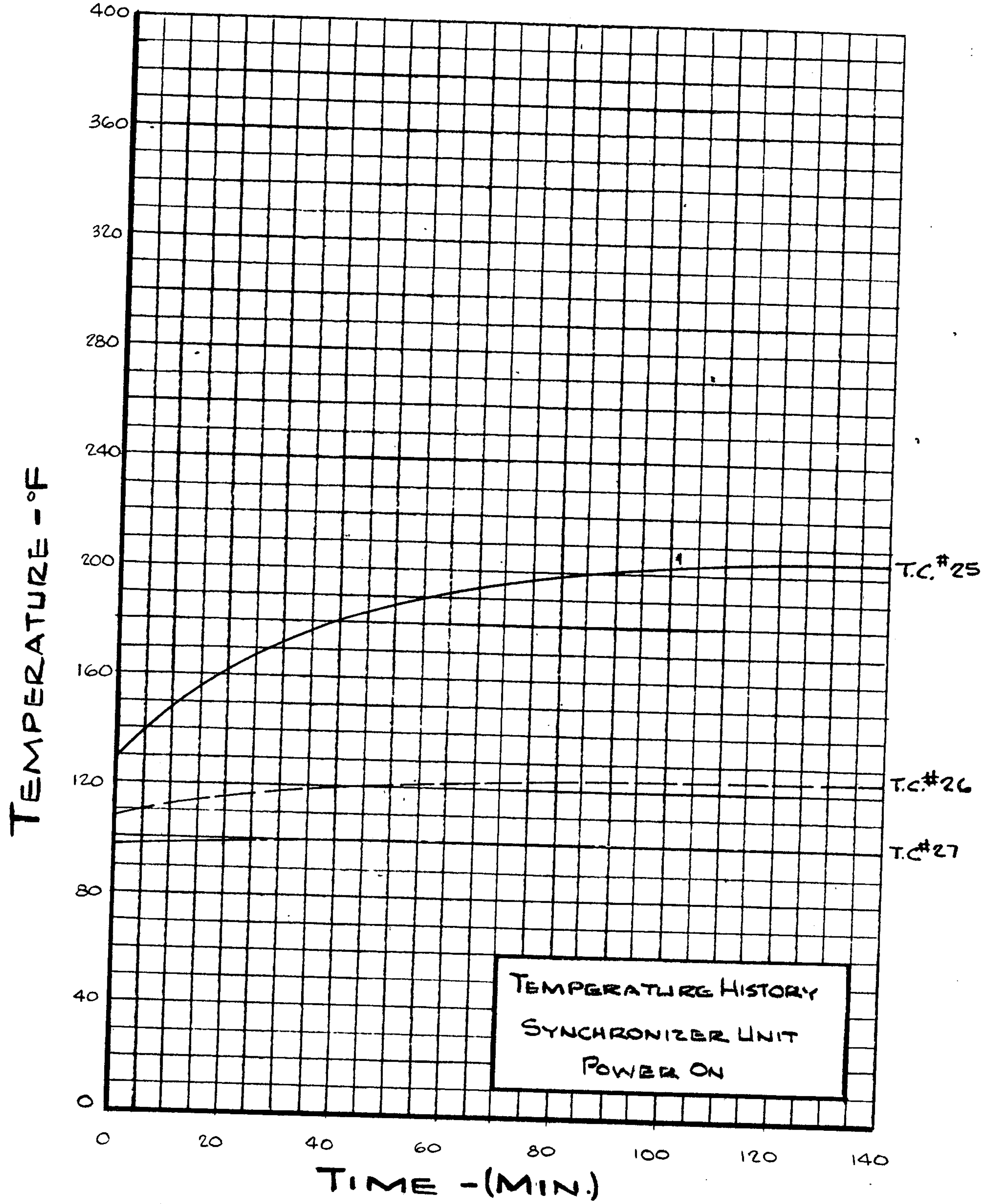

FIGURE Nº 16
(T.C. LOCATIONS FIG. Nº 3)

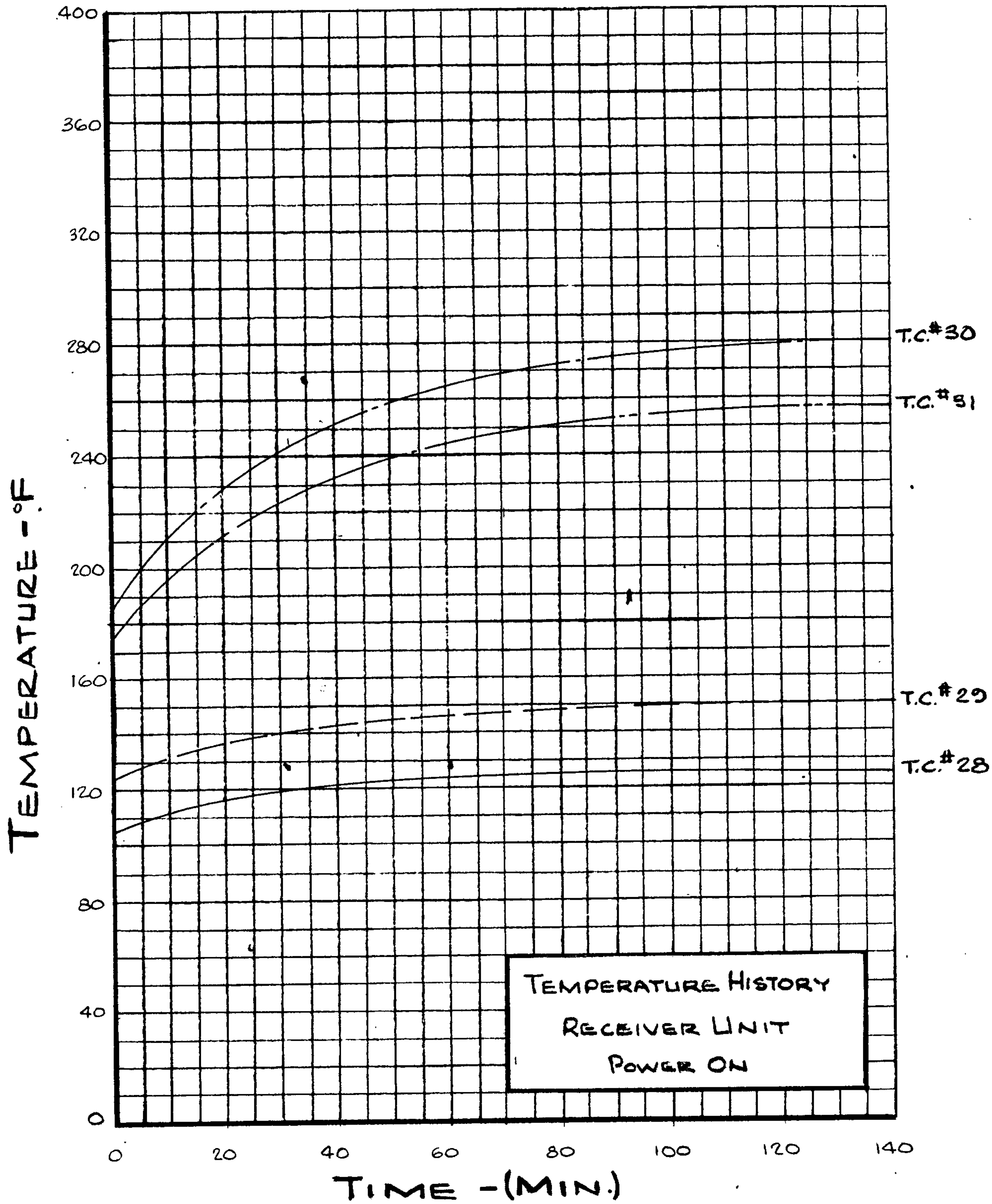

FIGURE Nº 17
(T.C. LOCATIONS FIG. Nº 4)

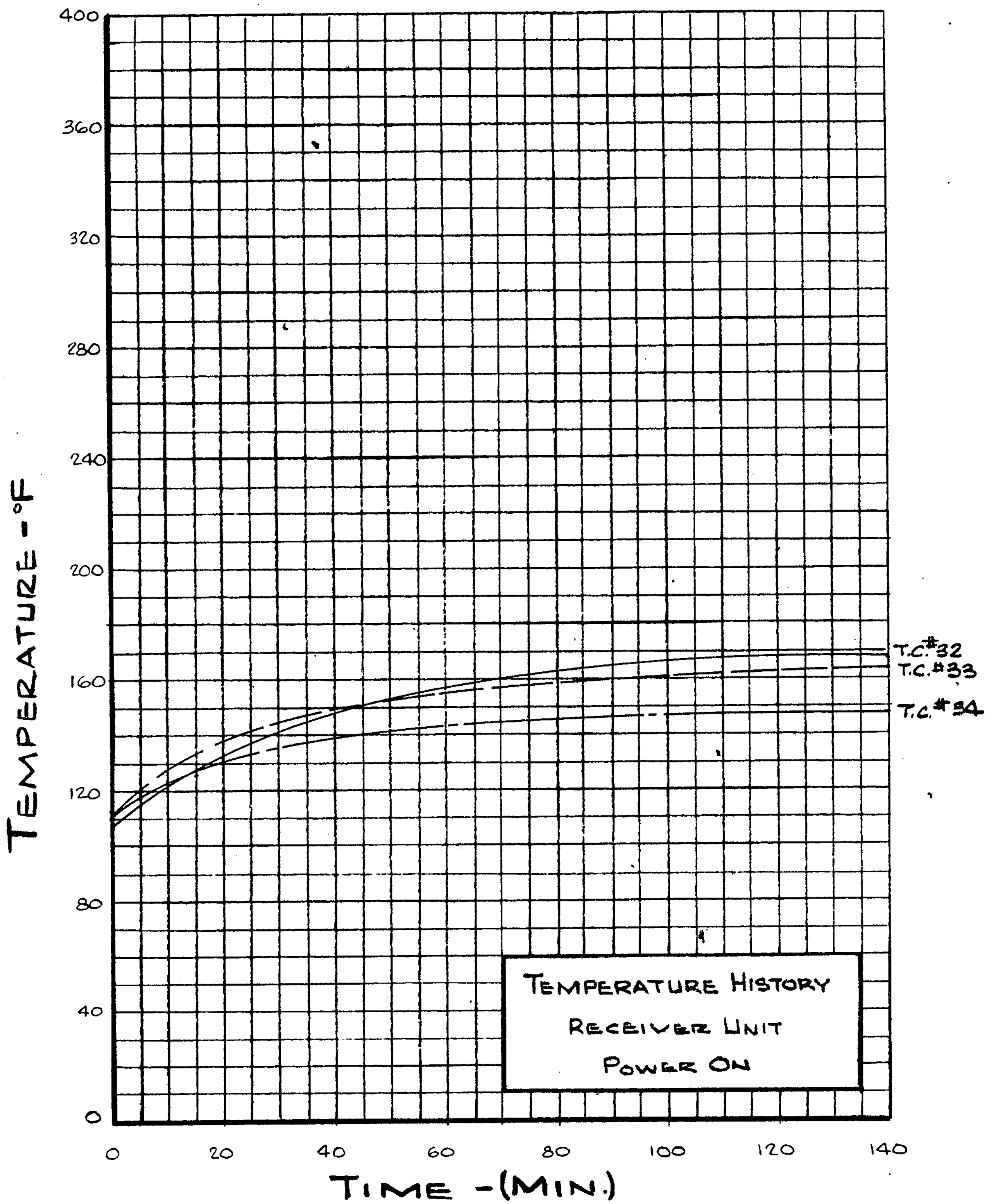

FIGURE Nº 18
(T.C. LOCATIONS FIG. Nº 4)

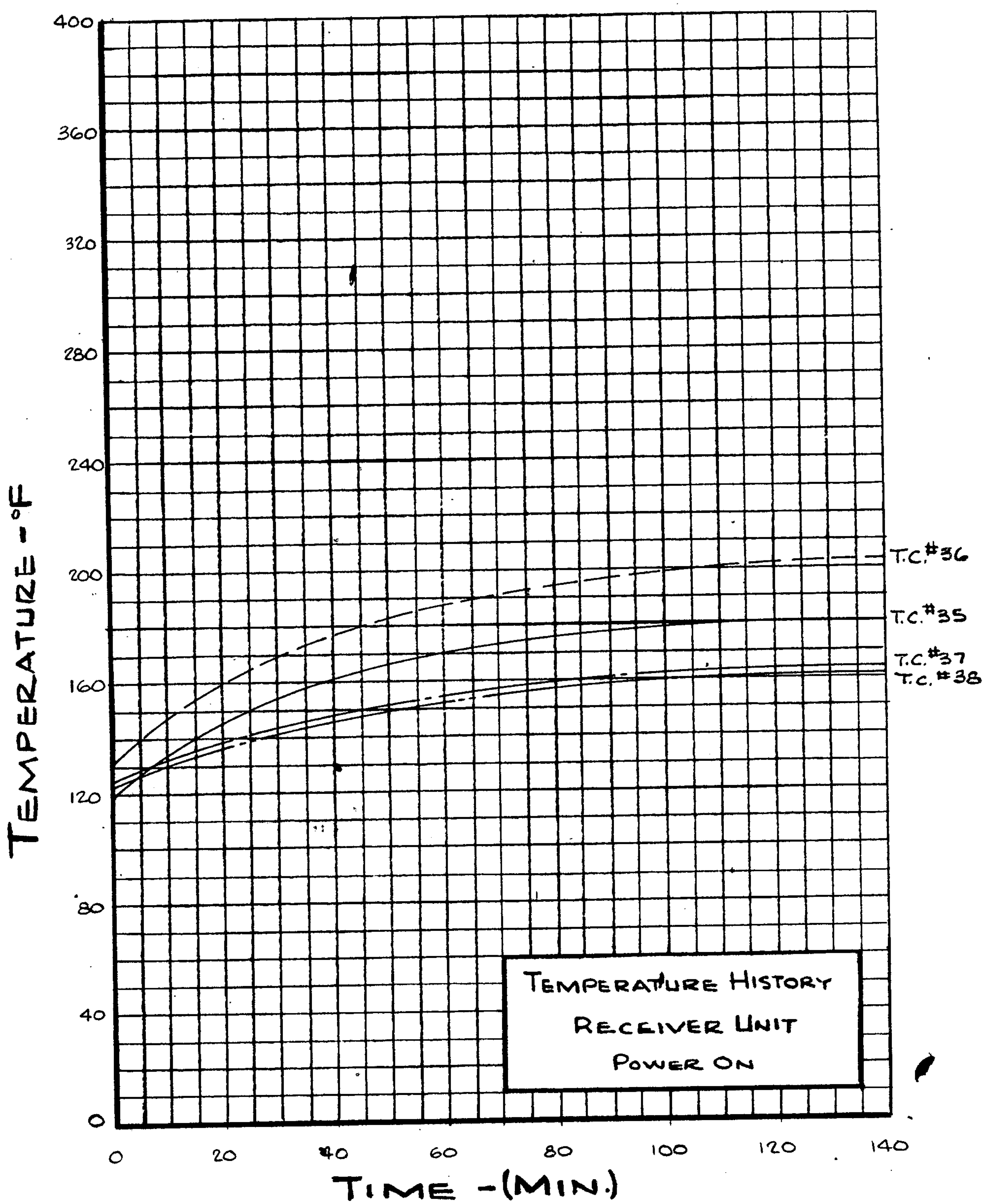

FIGURE Nº 19
(T.C. LOCATIONS FIG Nº 4)

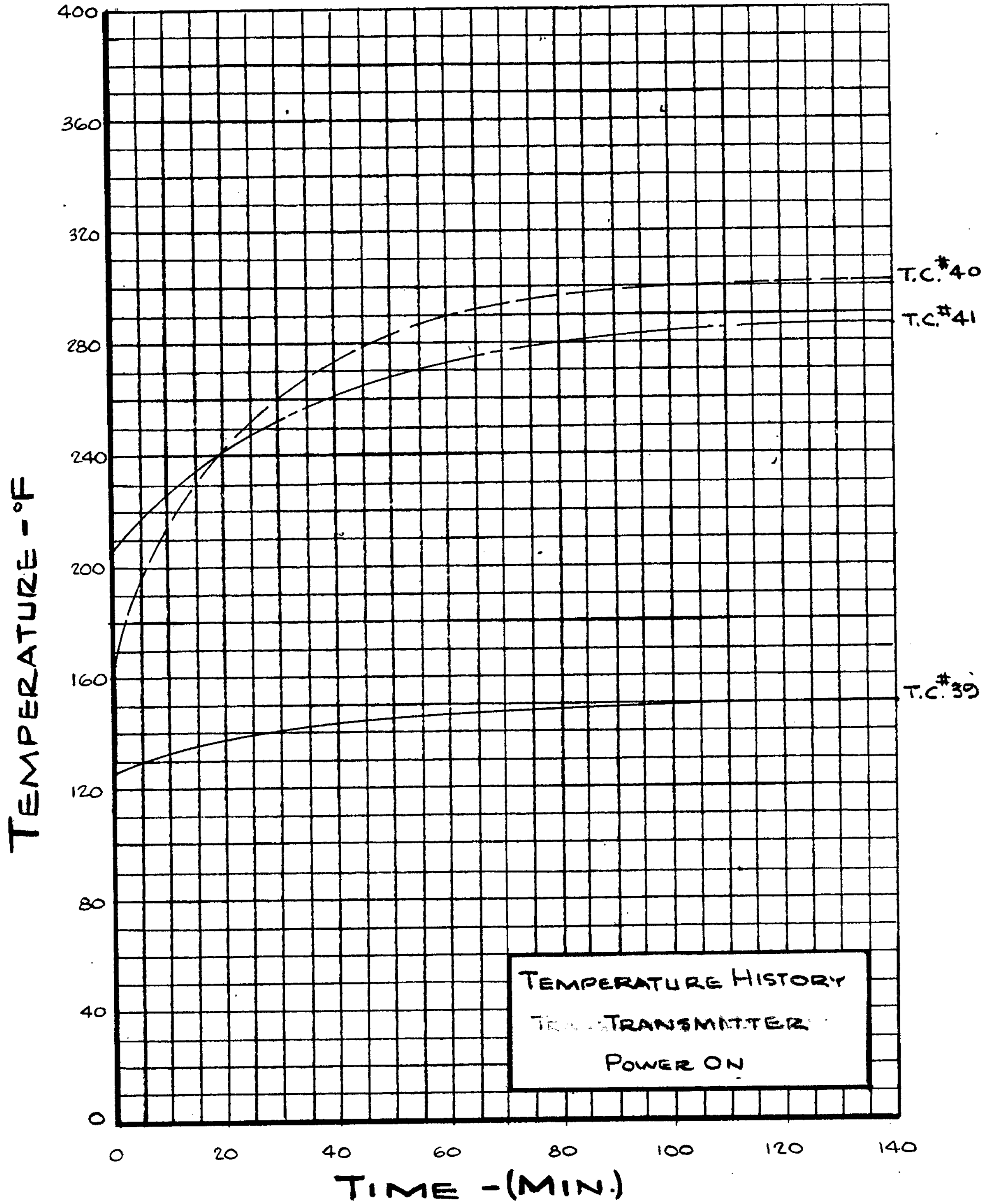

FIGURE Nº 20
(T.C. LOCATIONS FIG. Nº 5)

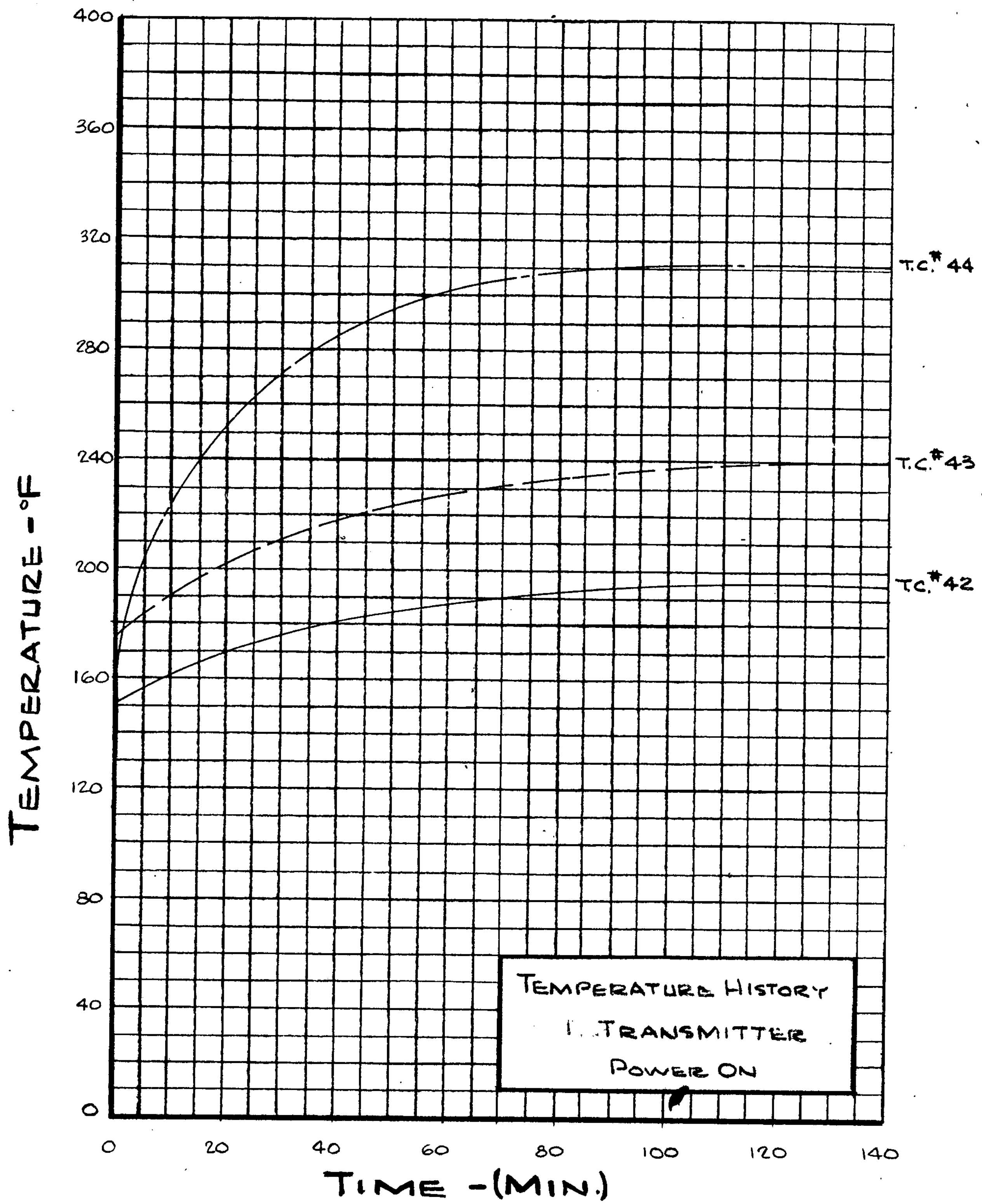

FIGURE Nº21
(T.C. LOCATIONS FIG. Nº 5)

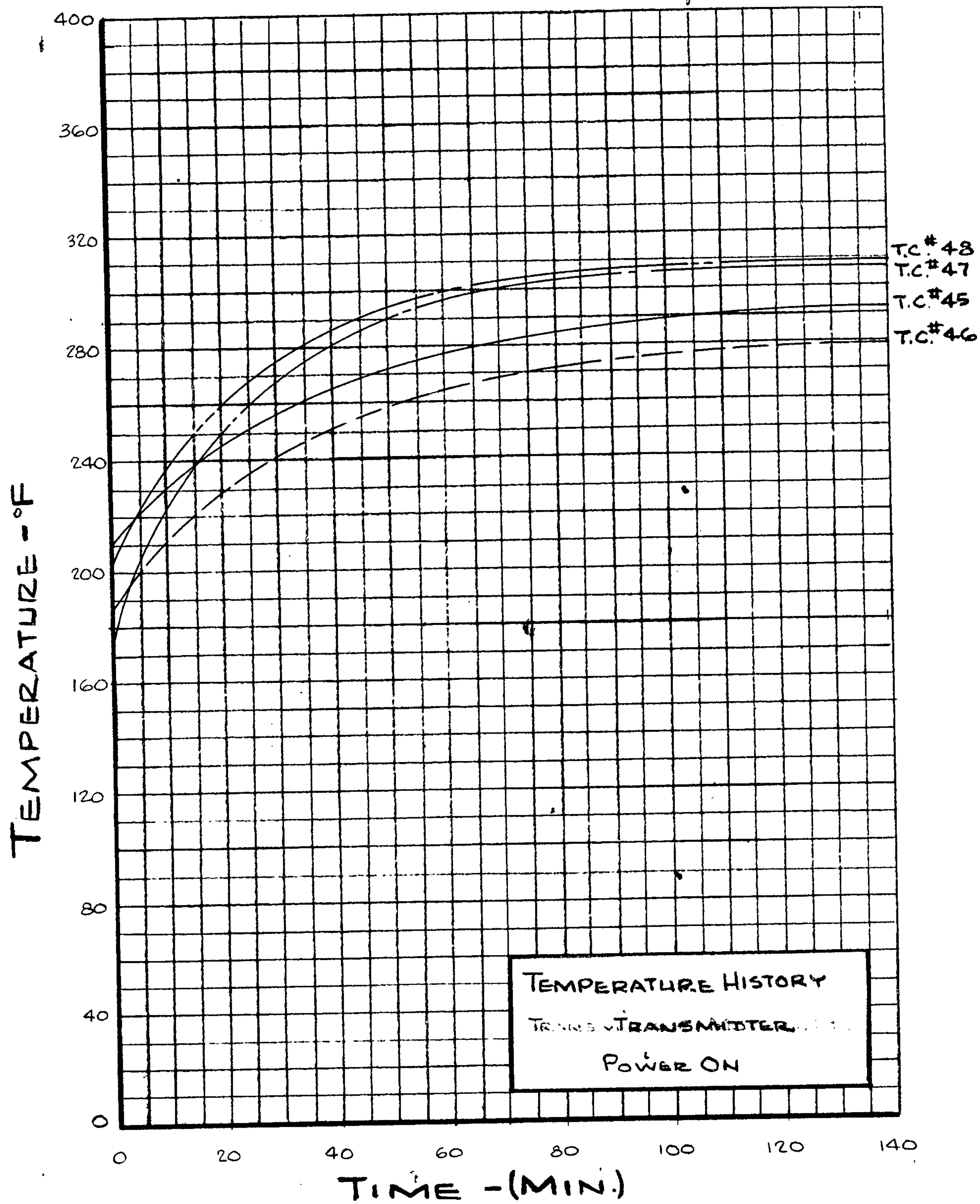

FIGURE Nº 22
(T.C. LOCATIONS FIG. Nº 5)

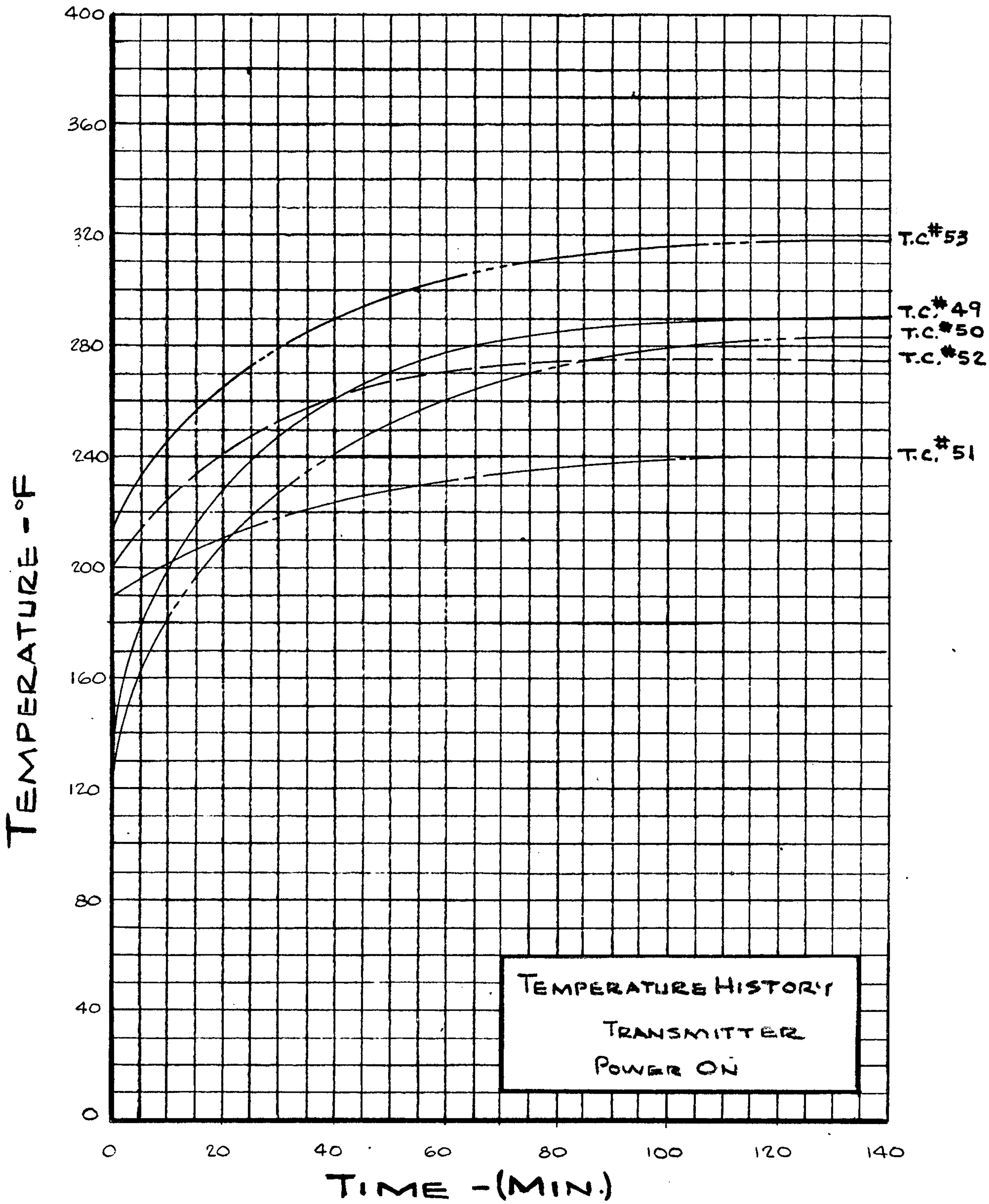

FIGURE № 23
(T.C. LOCATIONS FIG. № 5)

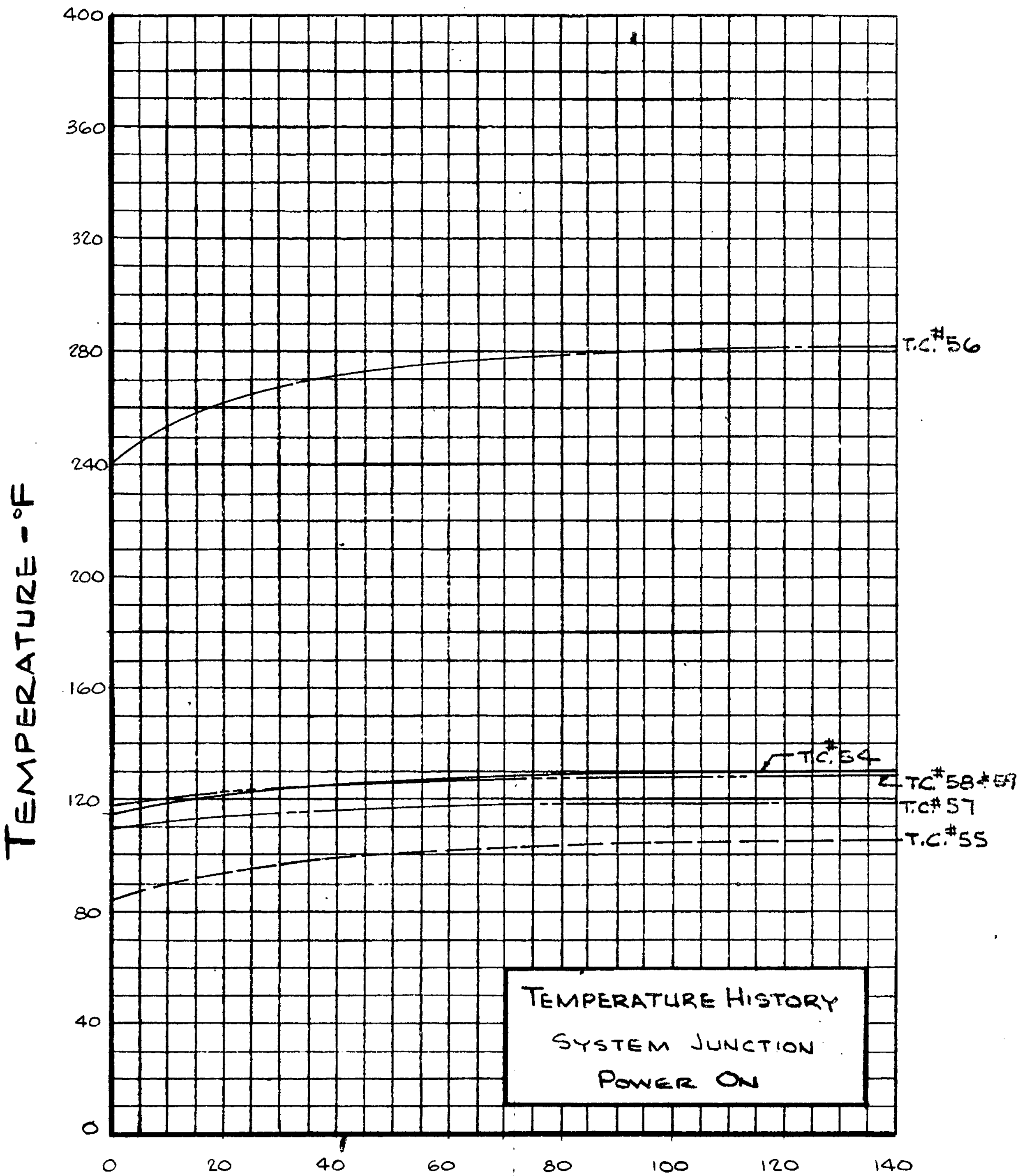

FIGURE Nº 24
(T.C. LOCATIONS FIG. Nº 6)

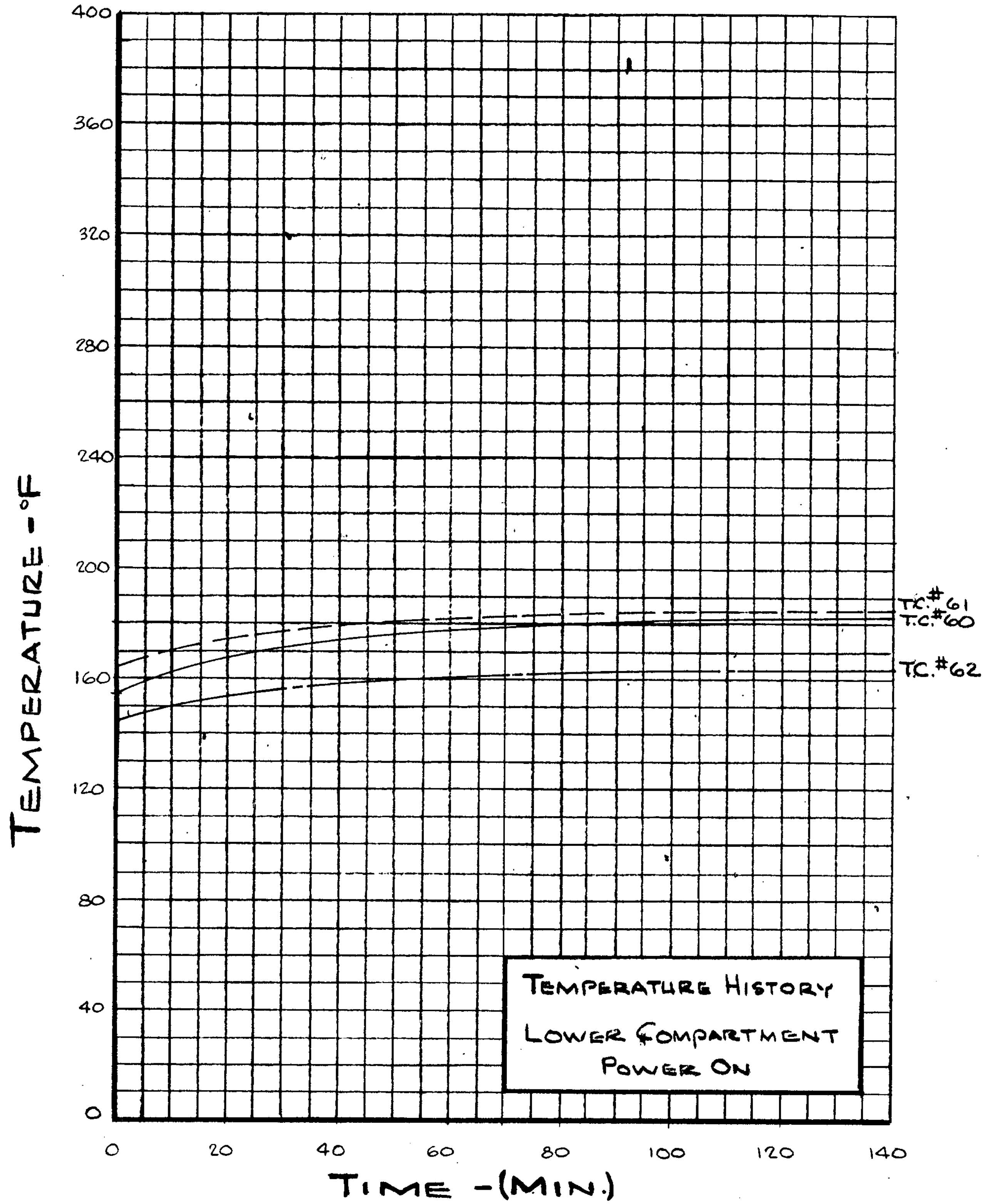

FIGURE Nº 25
(T.C. LOCATIONS FIG. Nº 7)

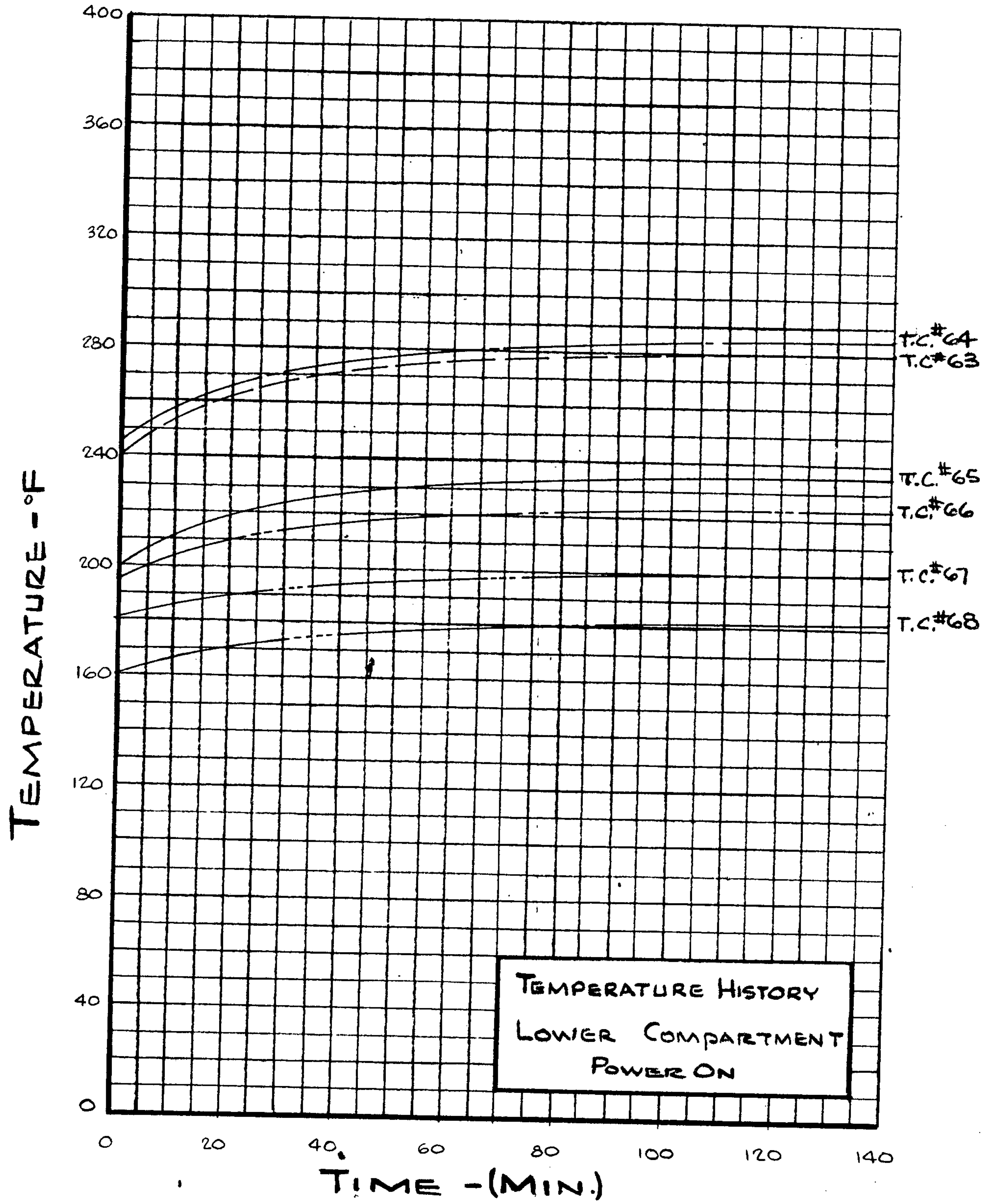

FIGURE Nº 26
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

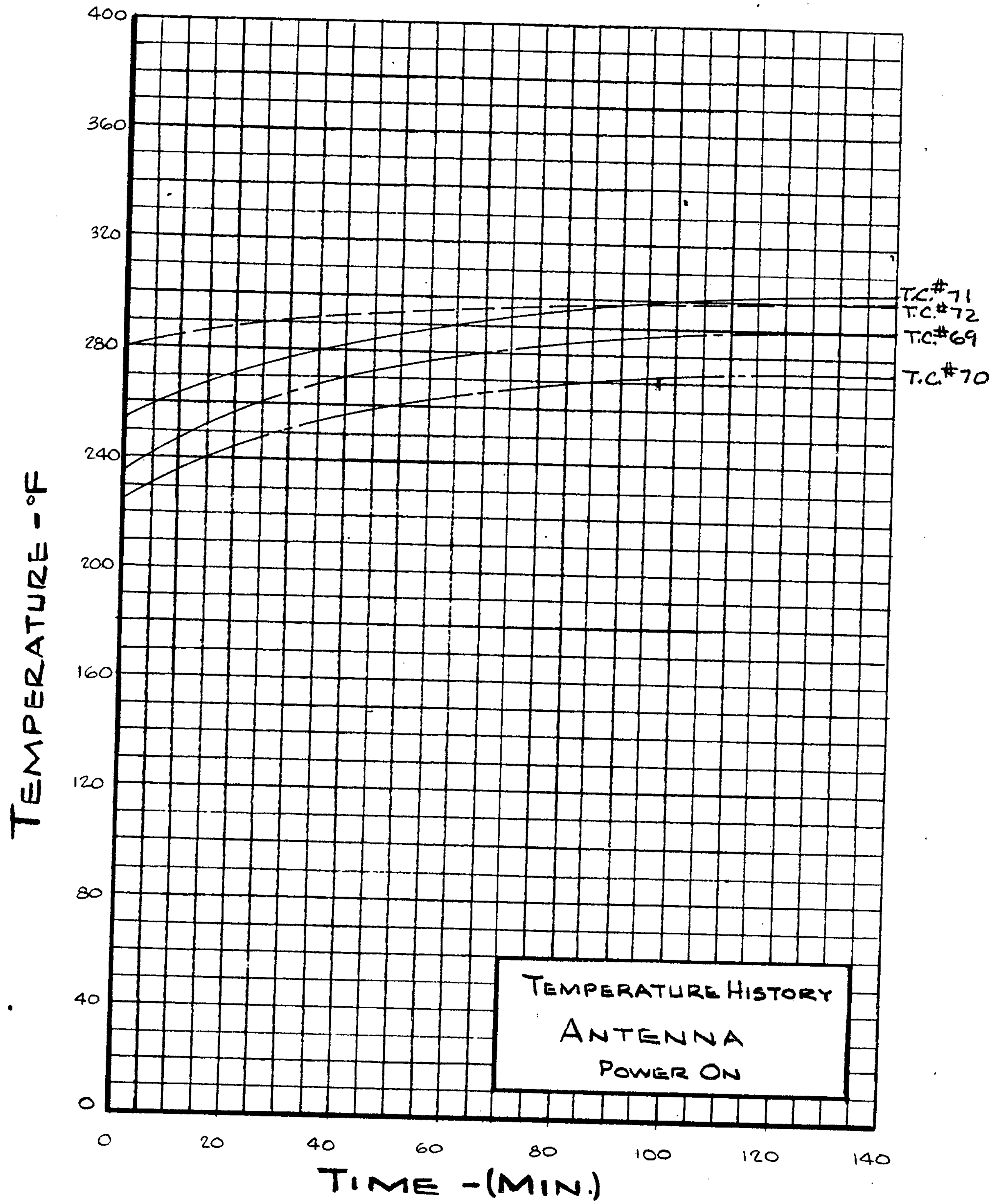

FIGURE Nº 27
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

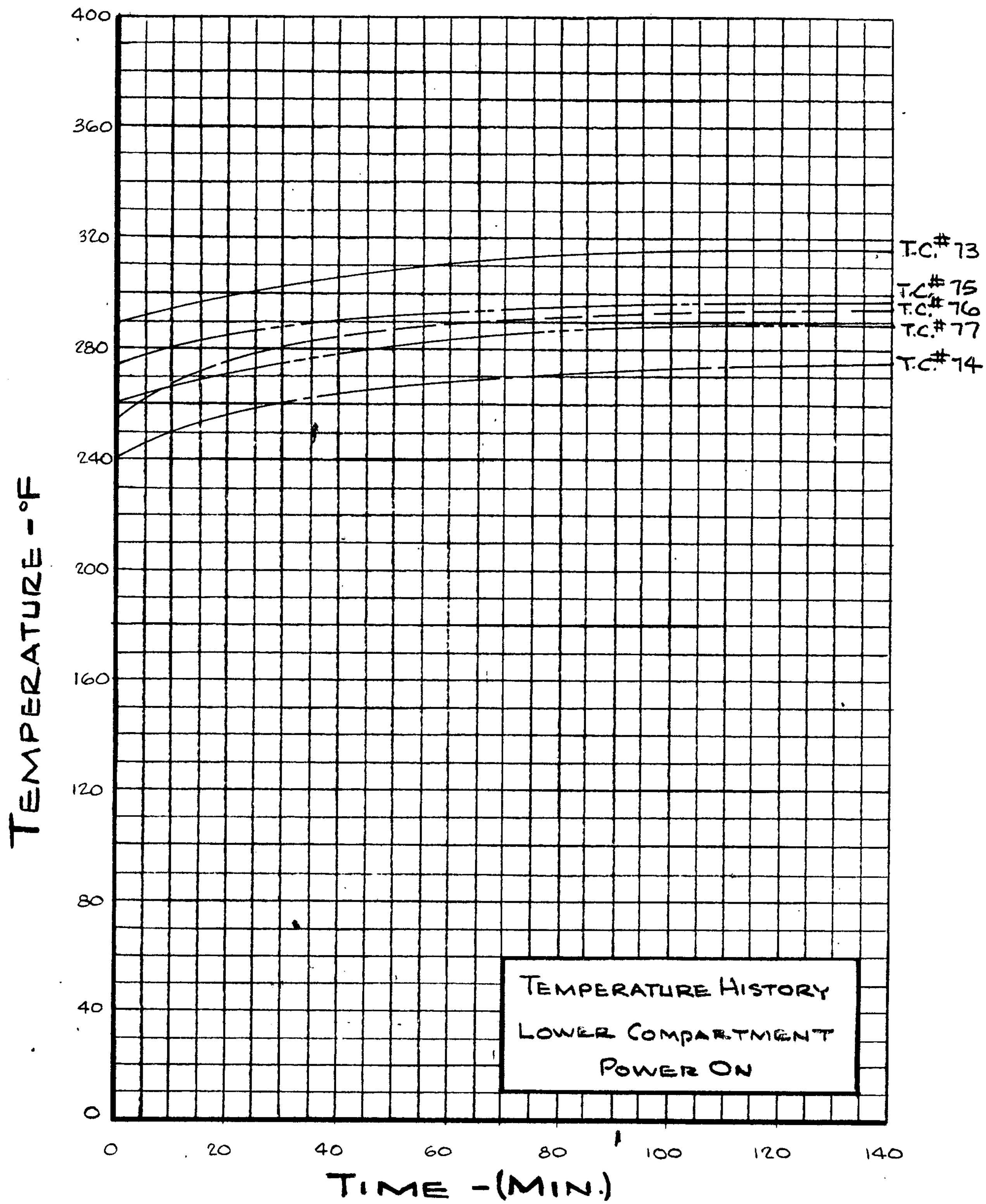

FIGURE Nº 28
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

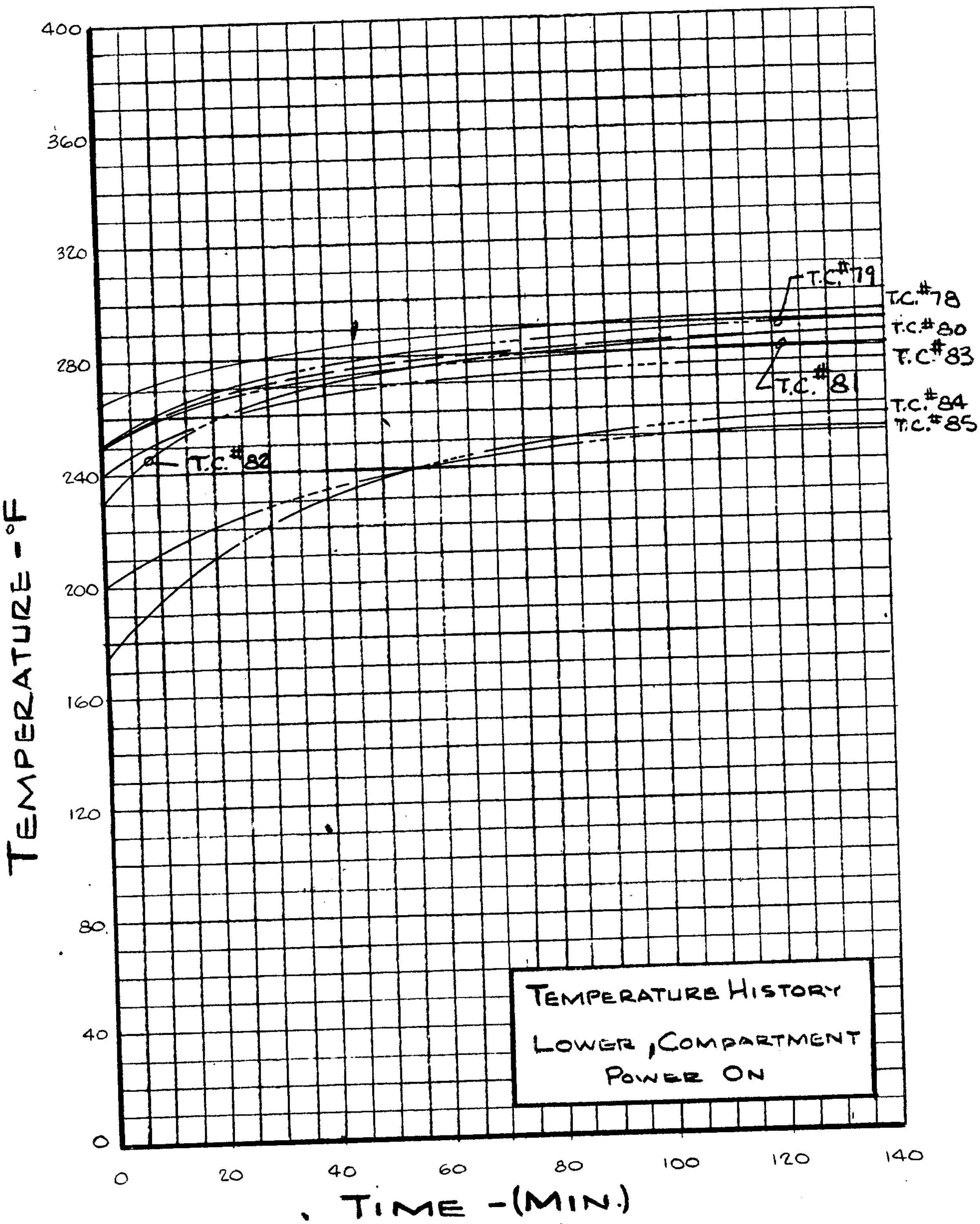

FIGURE Nº 29
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

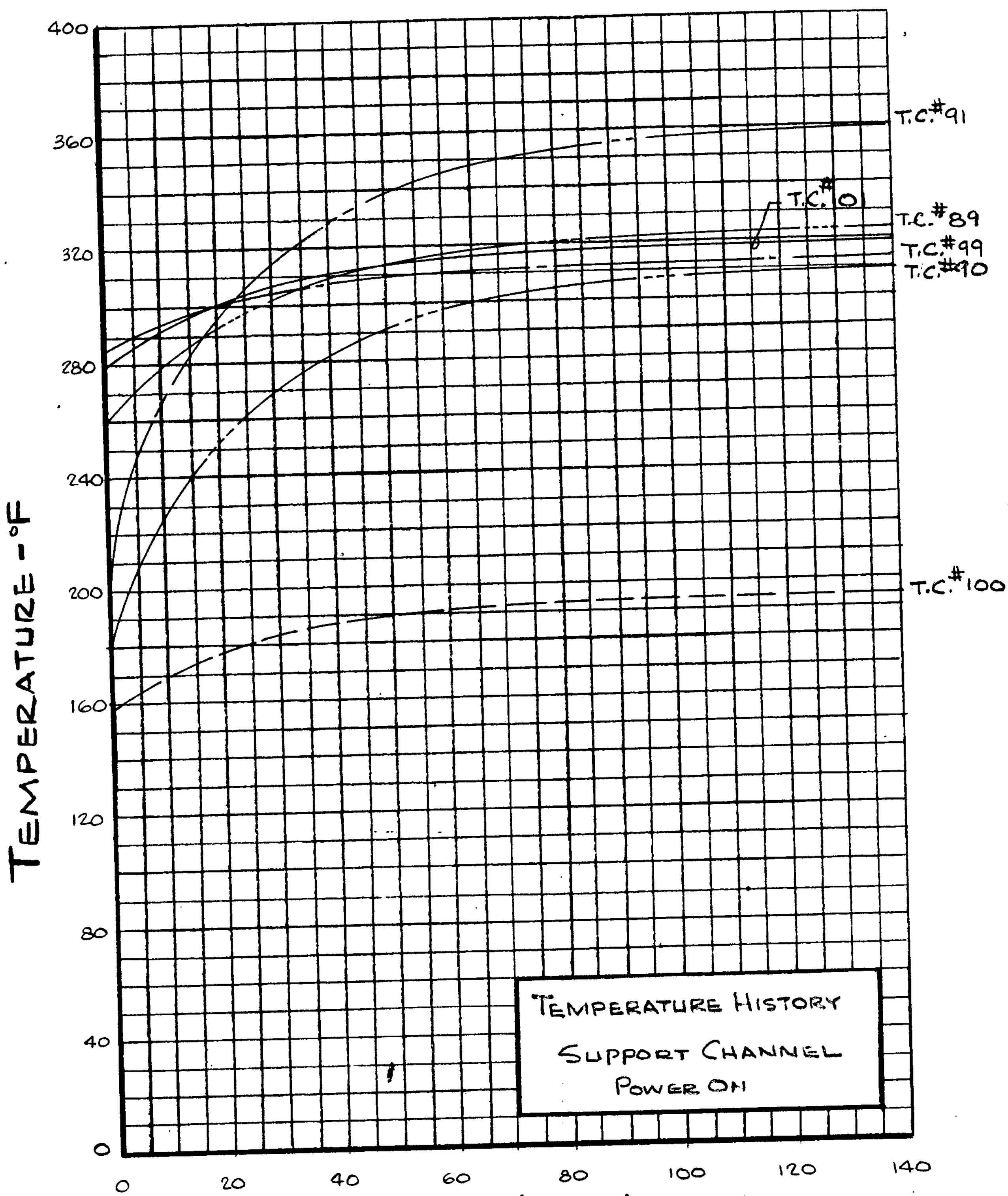

FIGURE Nº 30
(T.C. LOCATIONS FIG. Nº 7)

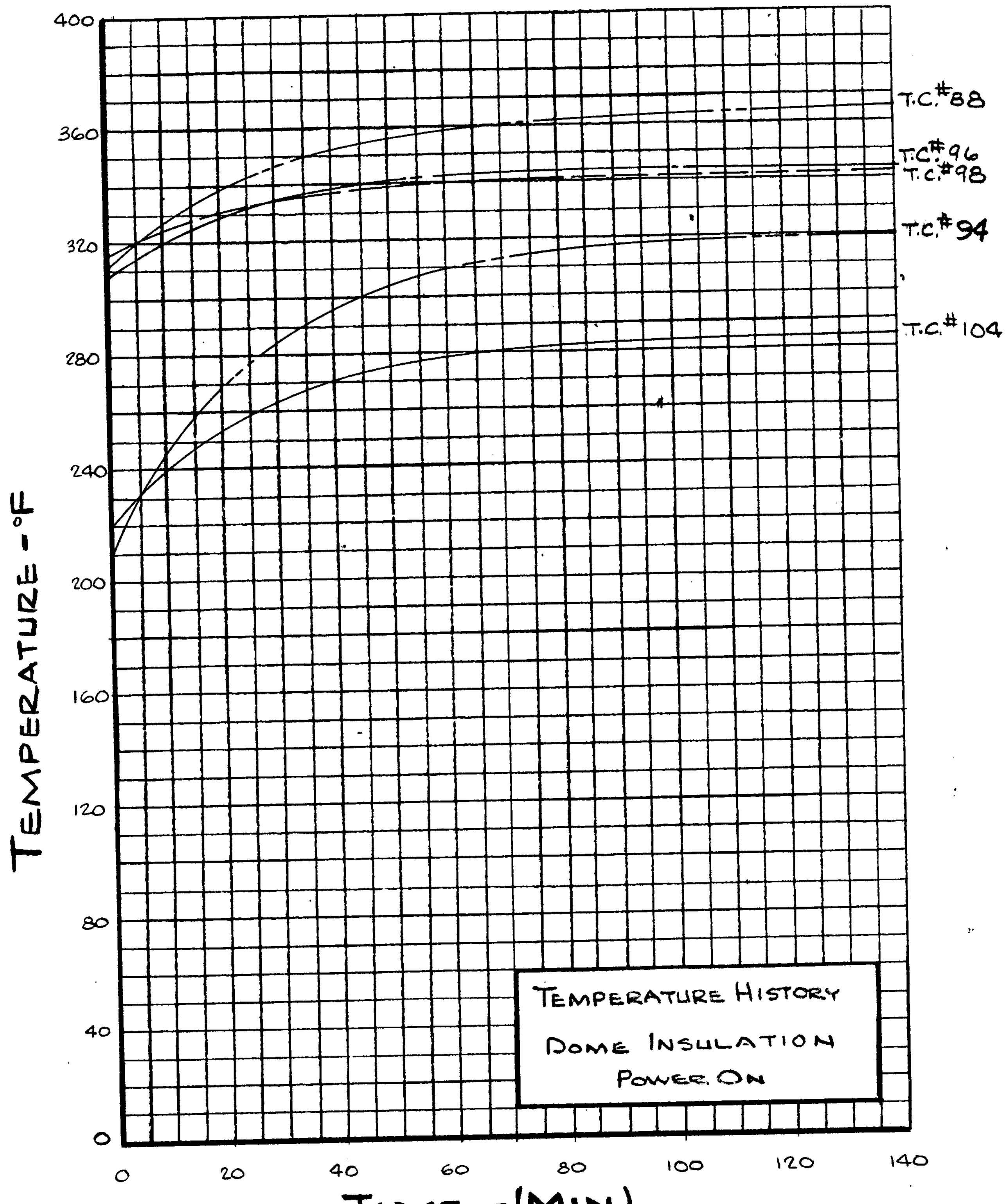

FIGURE Nº 31
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

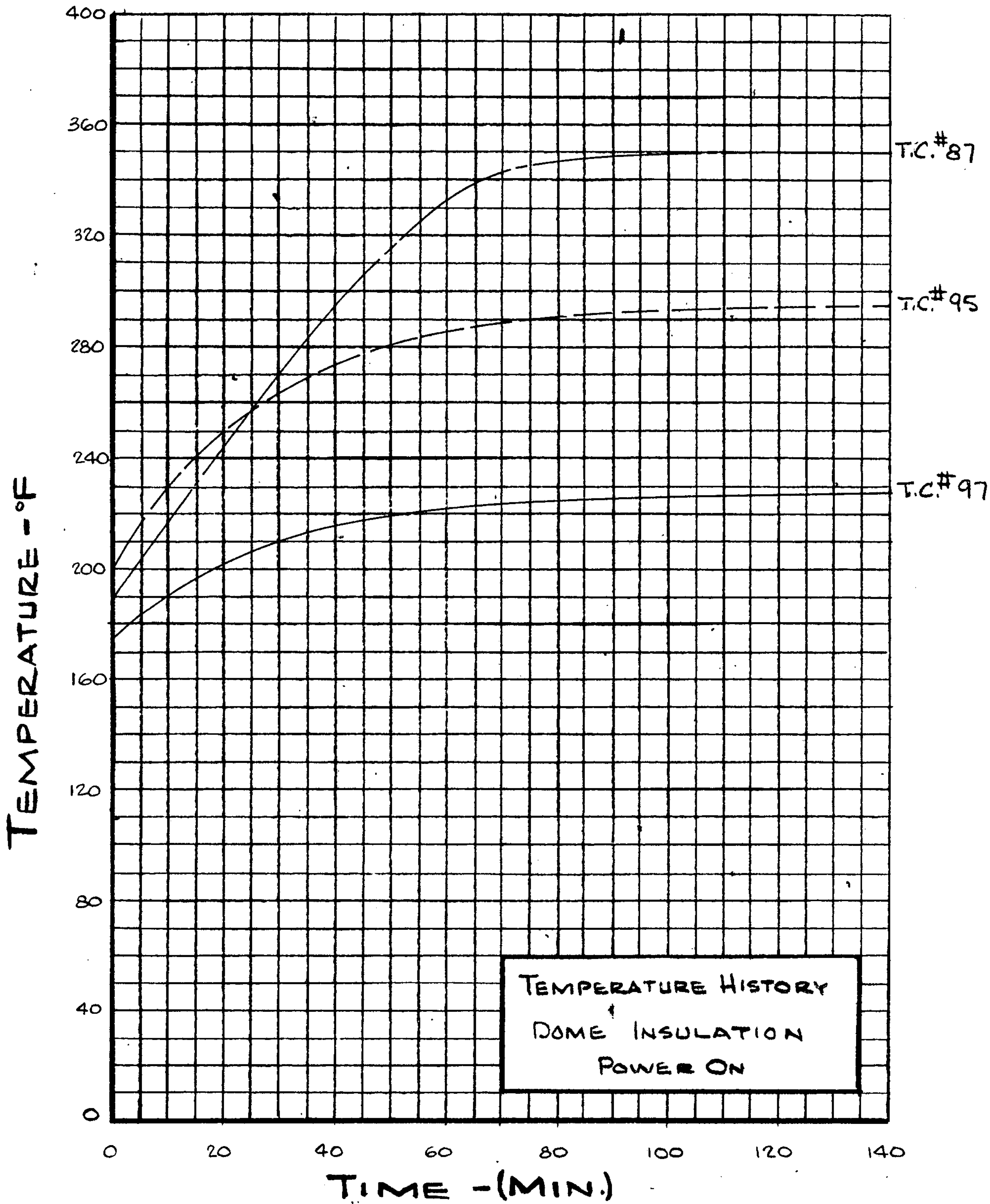

FIGURE Nº 32
(T.C. LOCATIONS FIG. Nº 7)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

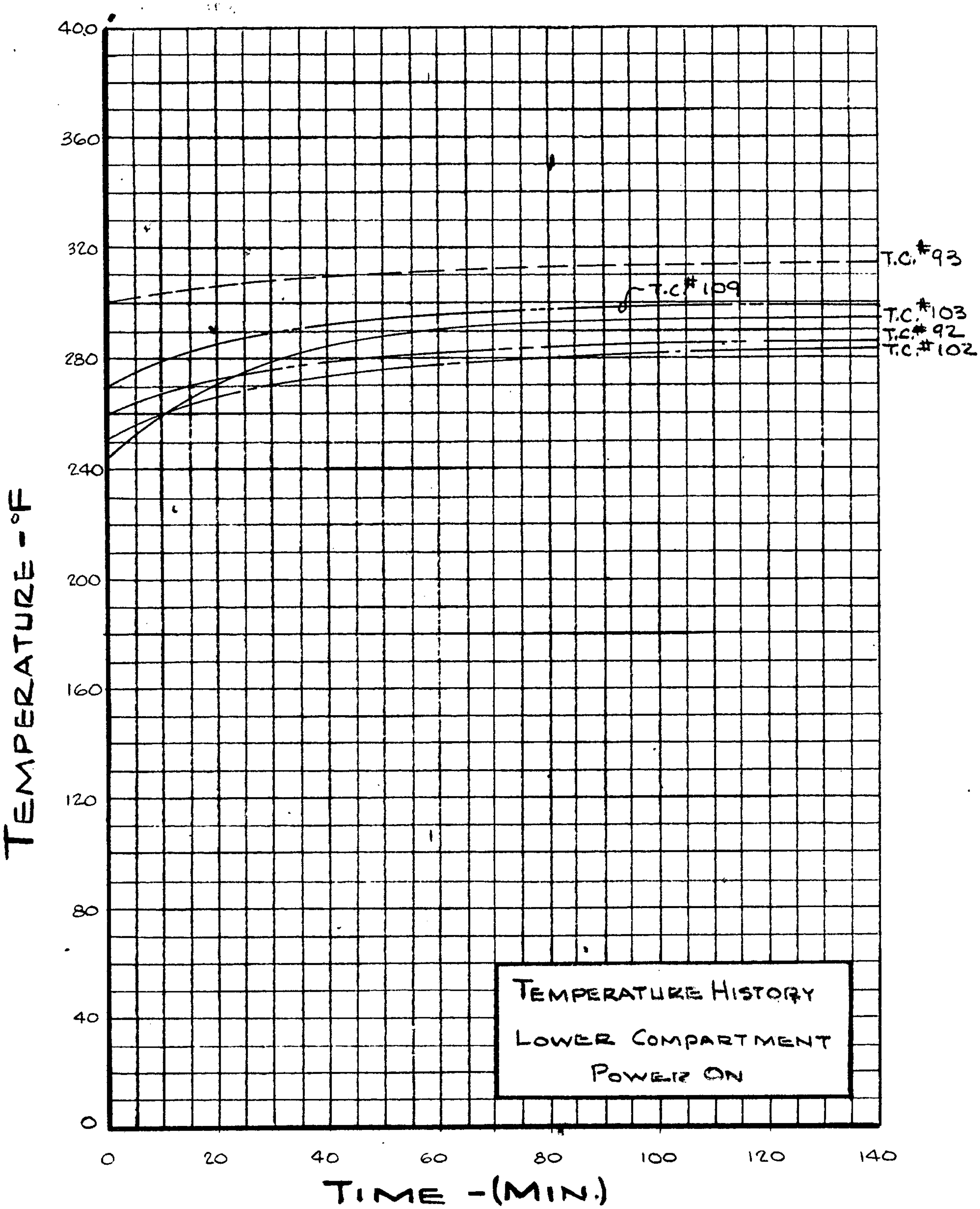

FIGURE Nº 33
(T.C. LOCATIONS FIG. Nº 7)

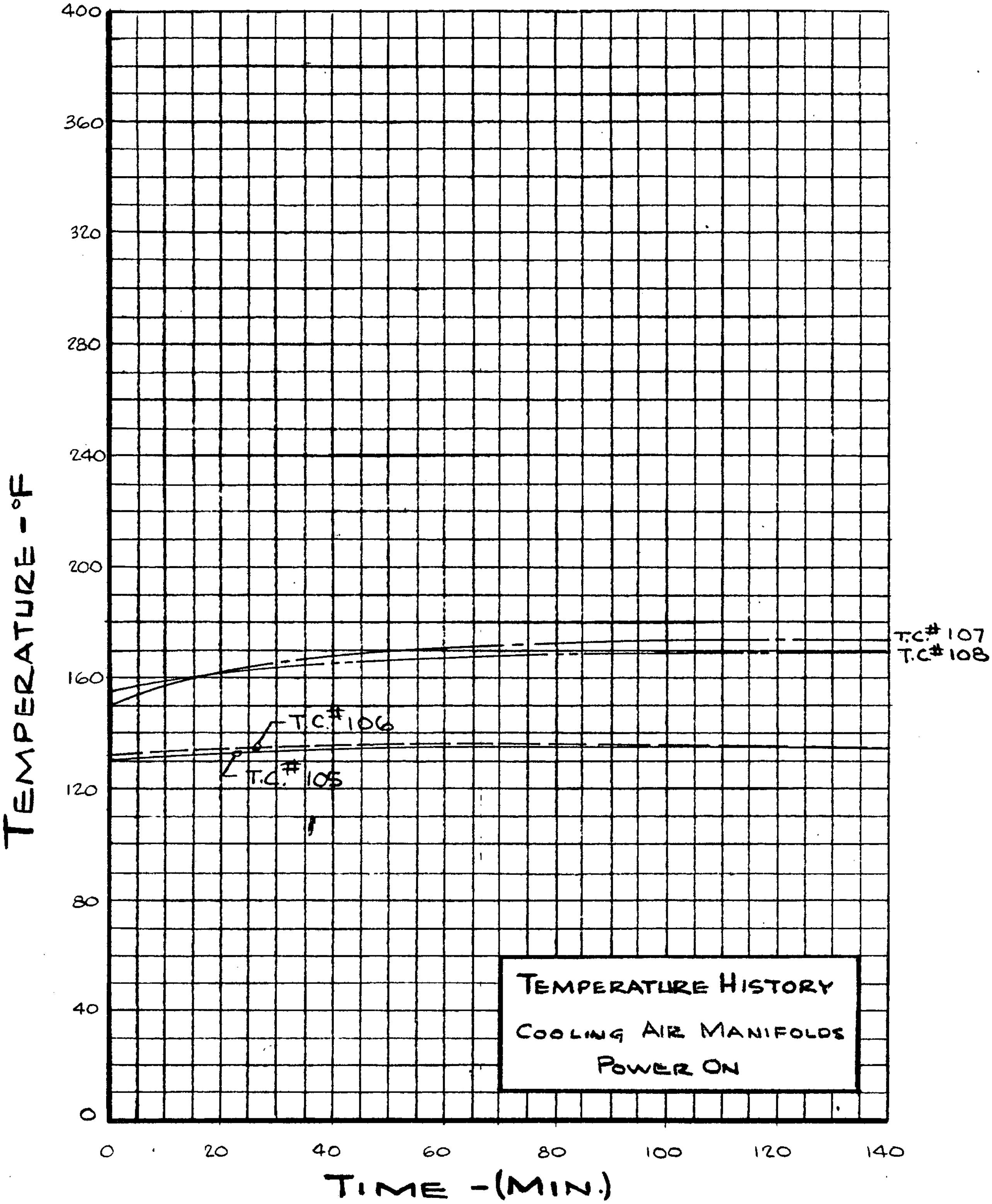

FIGURE Nº 34
(T.C. LOCATIONS FIG. Nº 7)

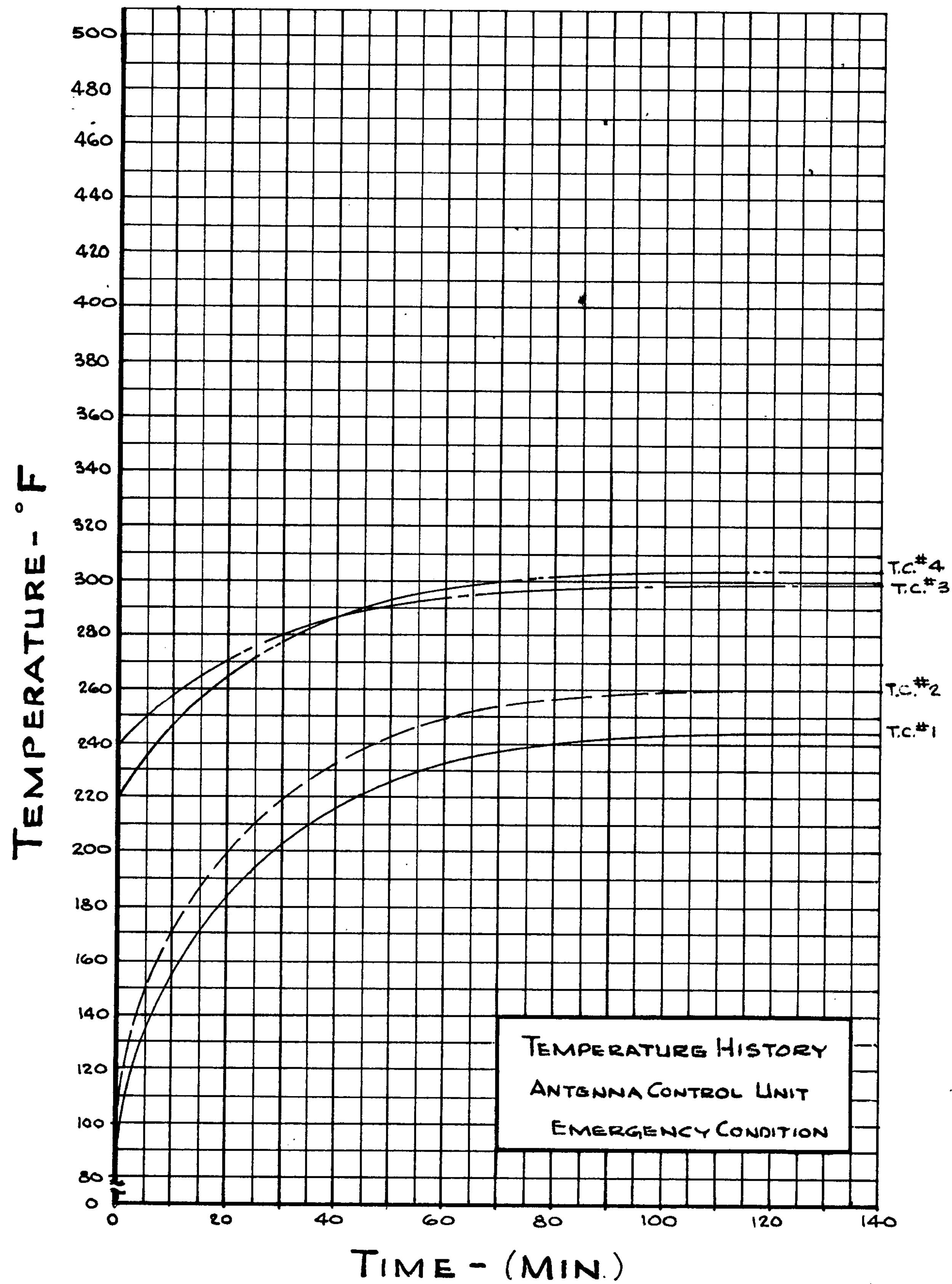

FIGURE Nº 35
(T.C. LOCATIONS FIG. Nº 2)

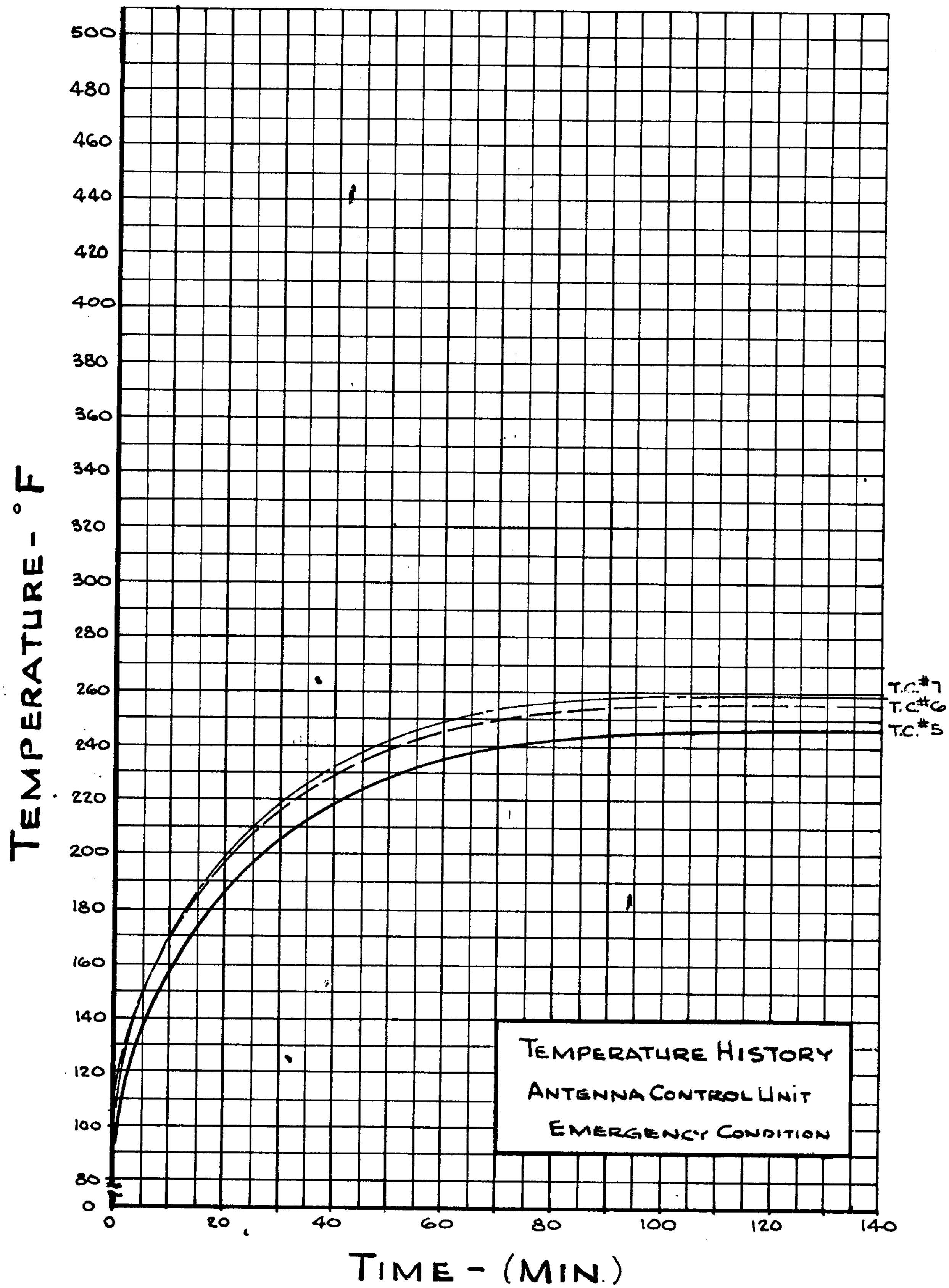

FIGURE Nº 36
(T.C. LOCATIONS FIG. Nº 2)

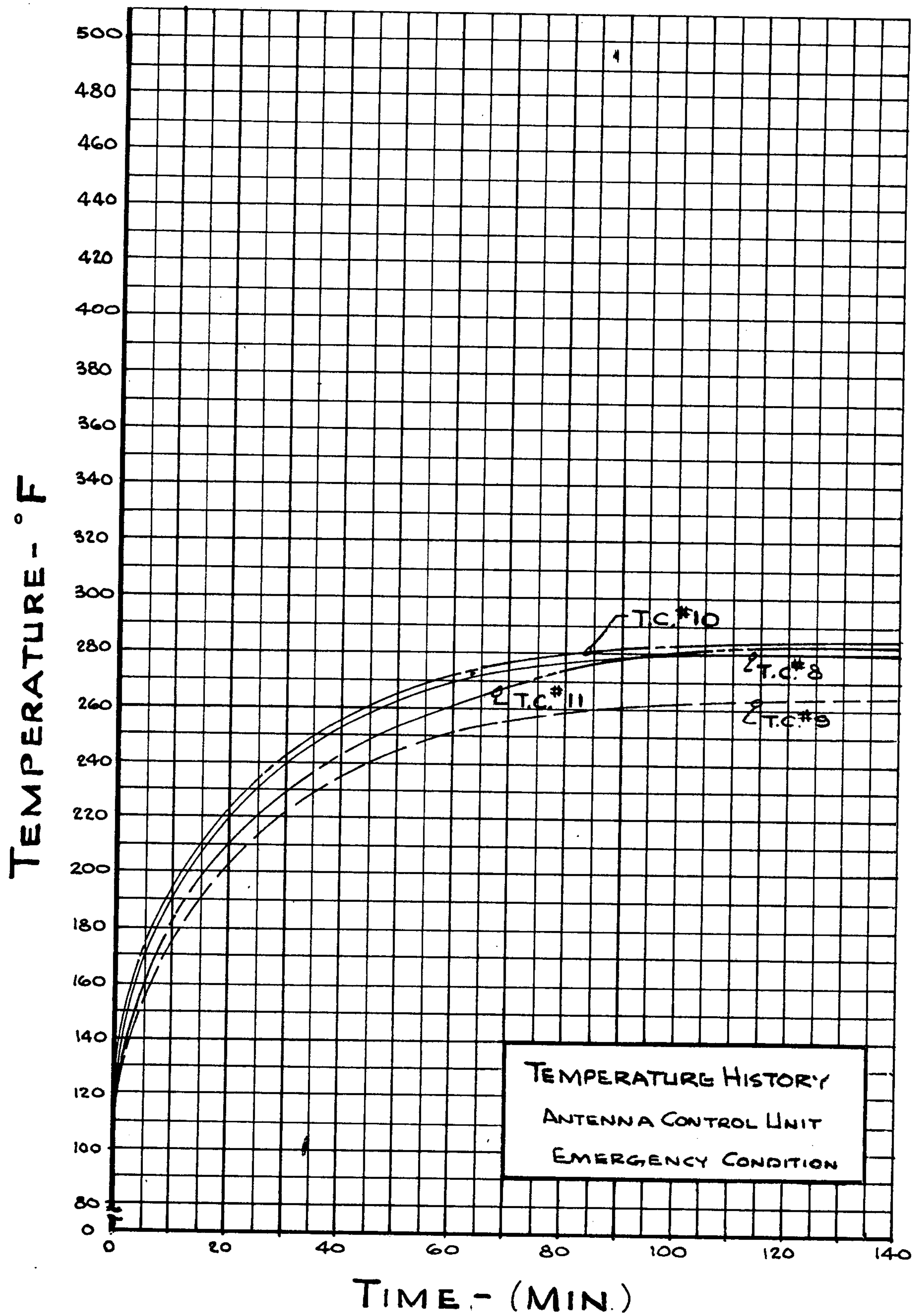

FIGURE Nº 37
(T.C. LOCATIONS FIG. Nº 2)

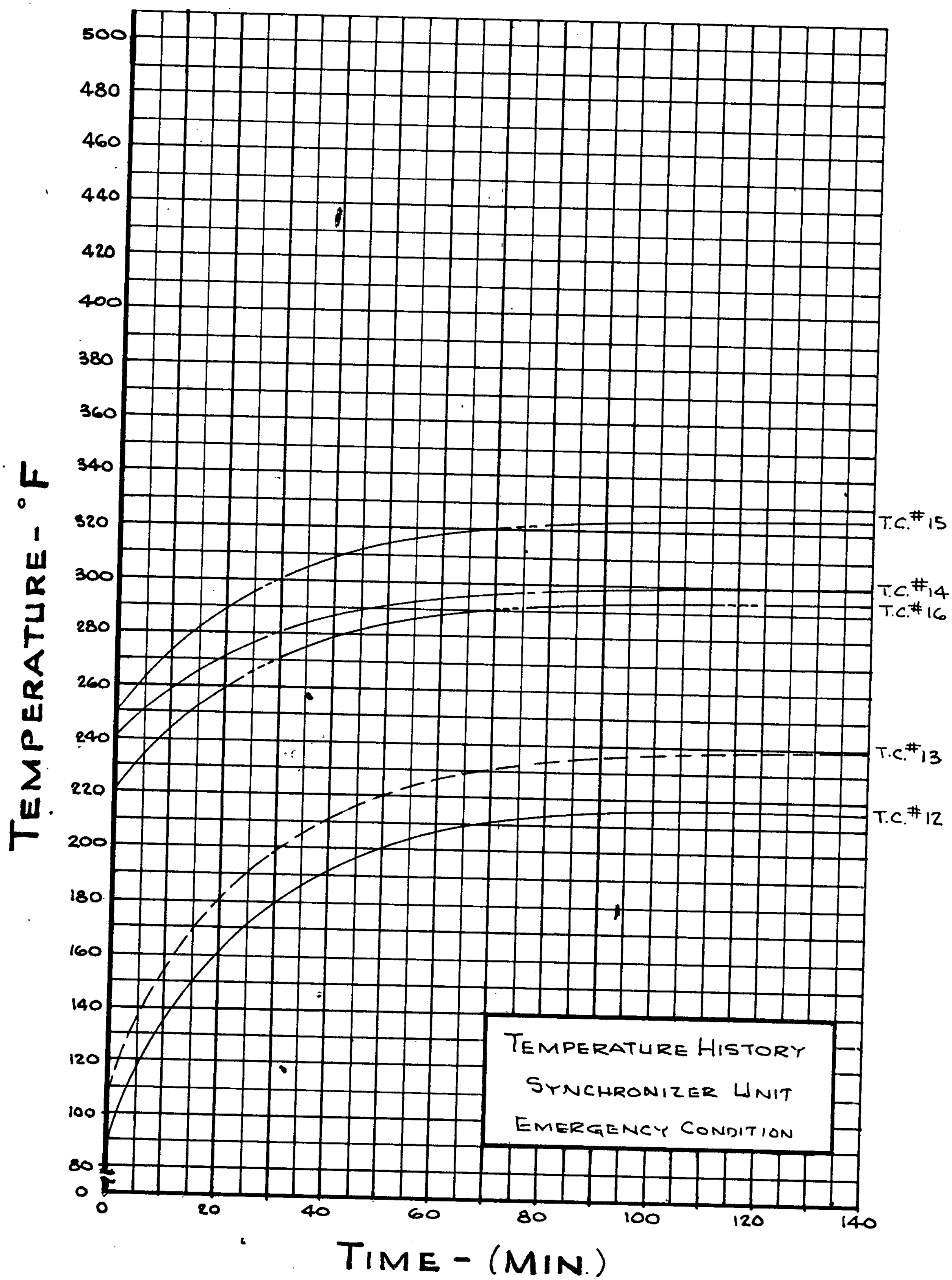

FIGURE Nº 38
(T.C LOCATIONS FIG. Nº 3)

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

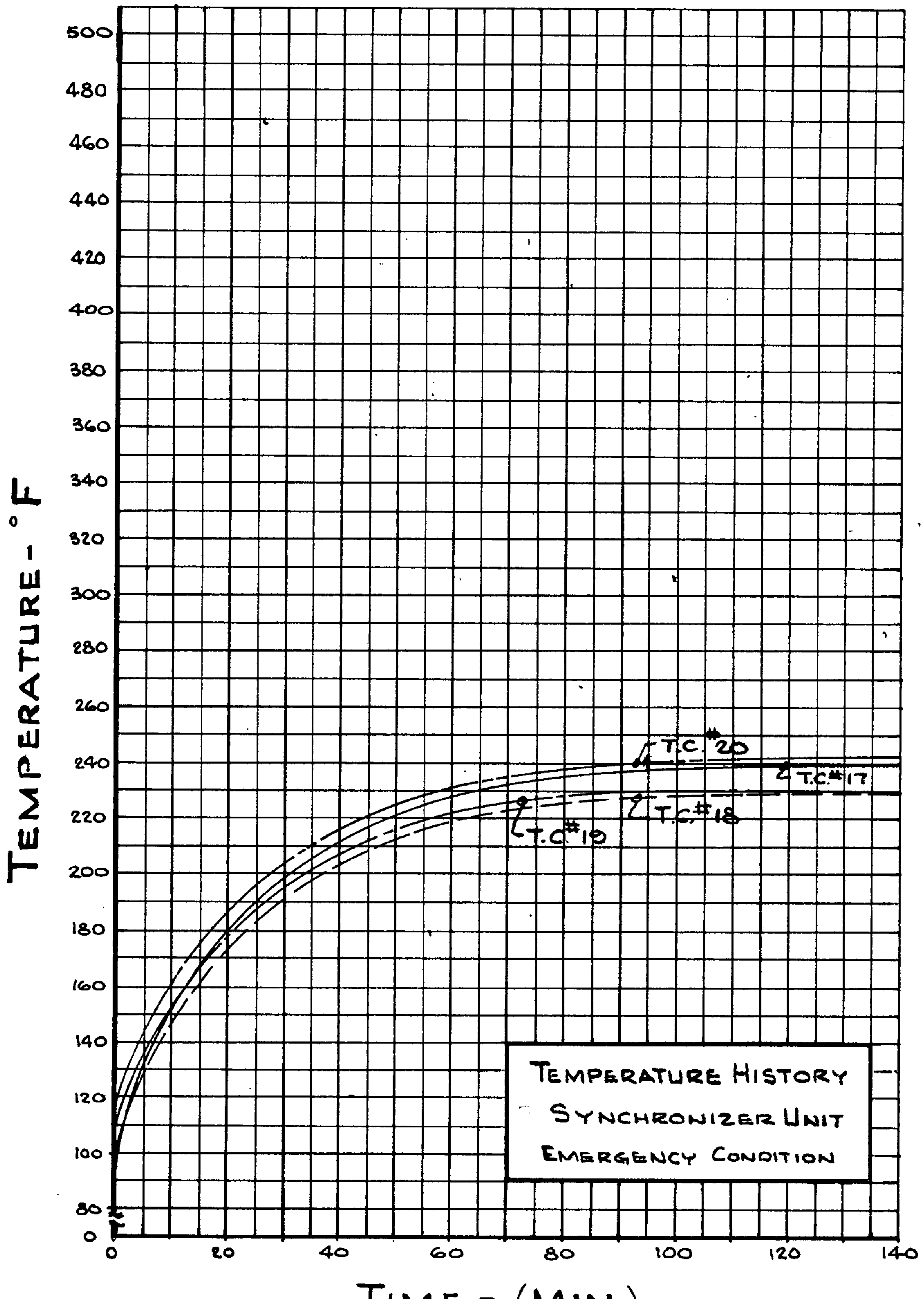

FIGURE Nº 39
(T.C. LOCATIONS FIG. Nº 3)

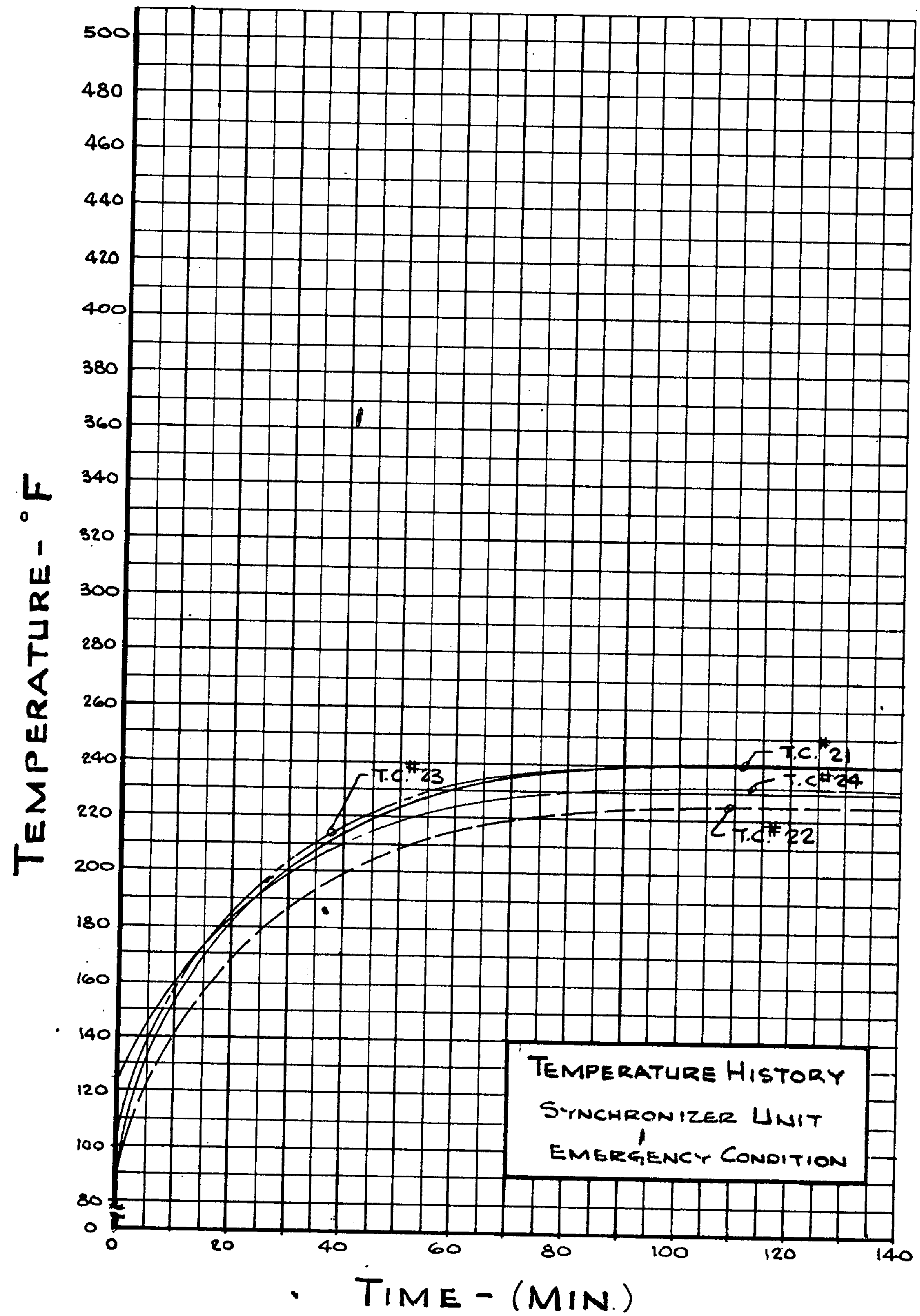

FIGURE Nº 40
(T.C. LOCATIONS FIG. Nº 3)

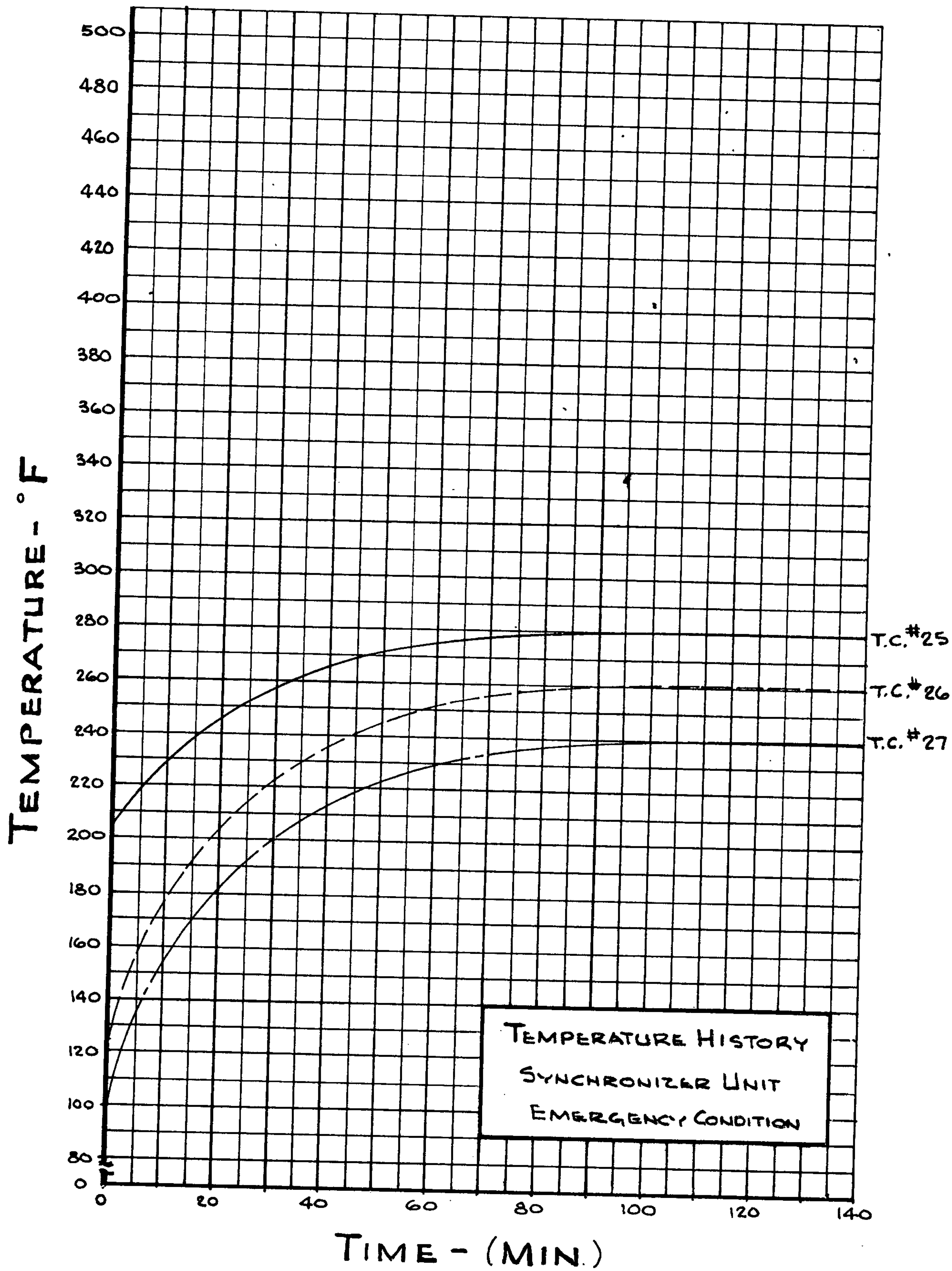

FIGURE Nº 41
(T.C. LOCATIONS FIG. Nº 3)

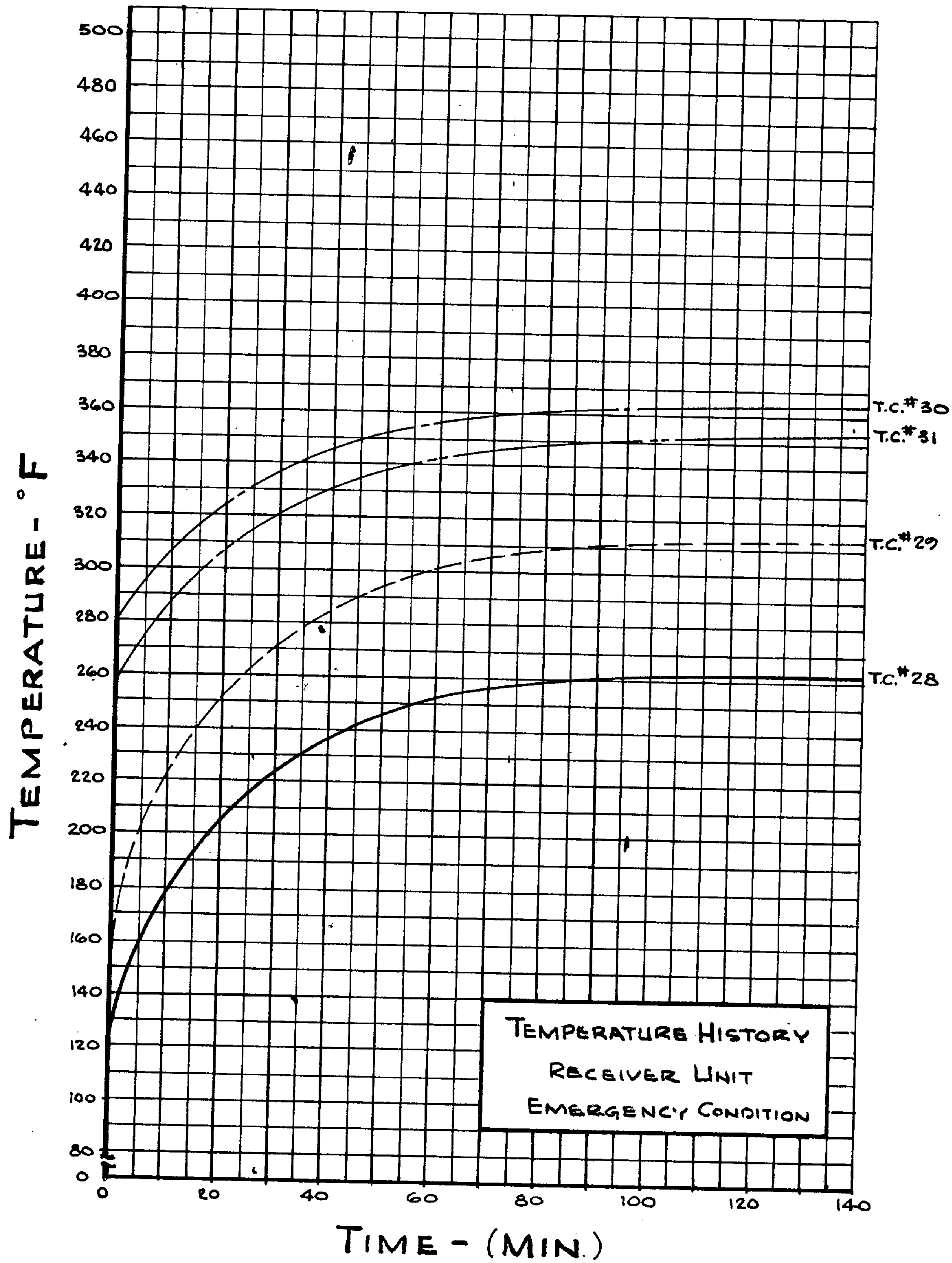

FIGURE Nº 42
(T.C. LOCATIONS FIG. Nº 4)

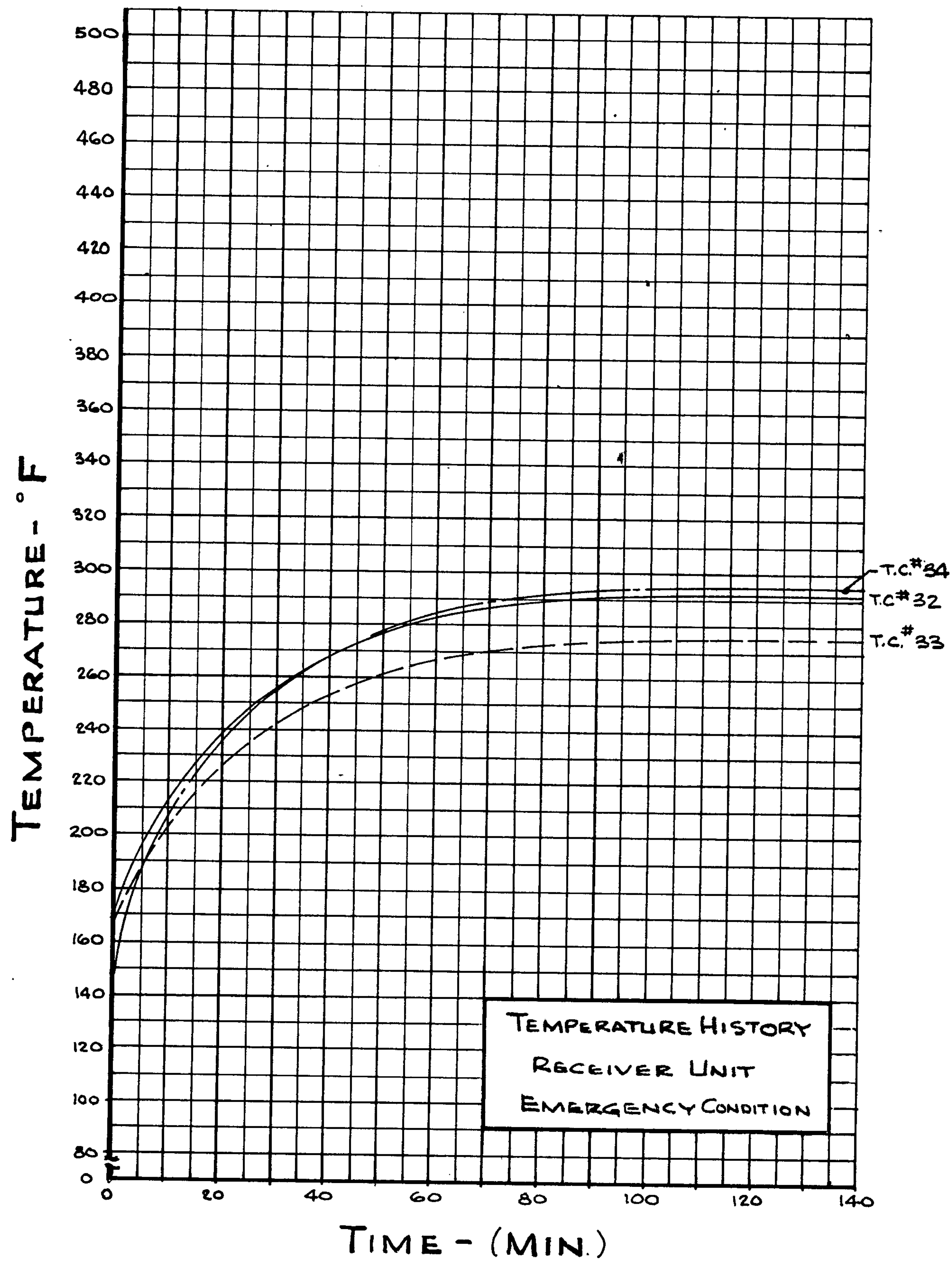

FIGURE Nº 43
(T.C. LOCATIONS FIG. Nº 4)

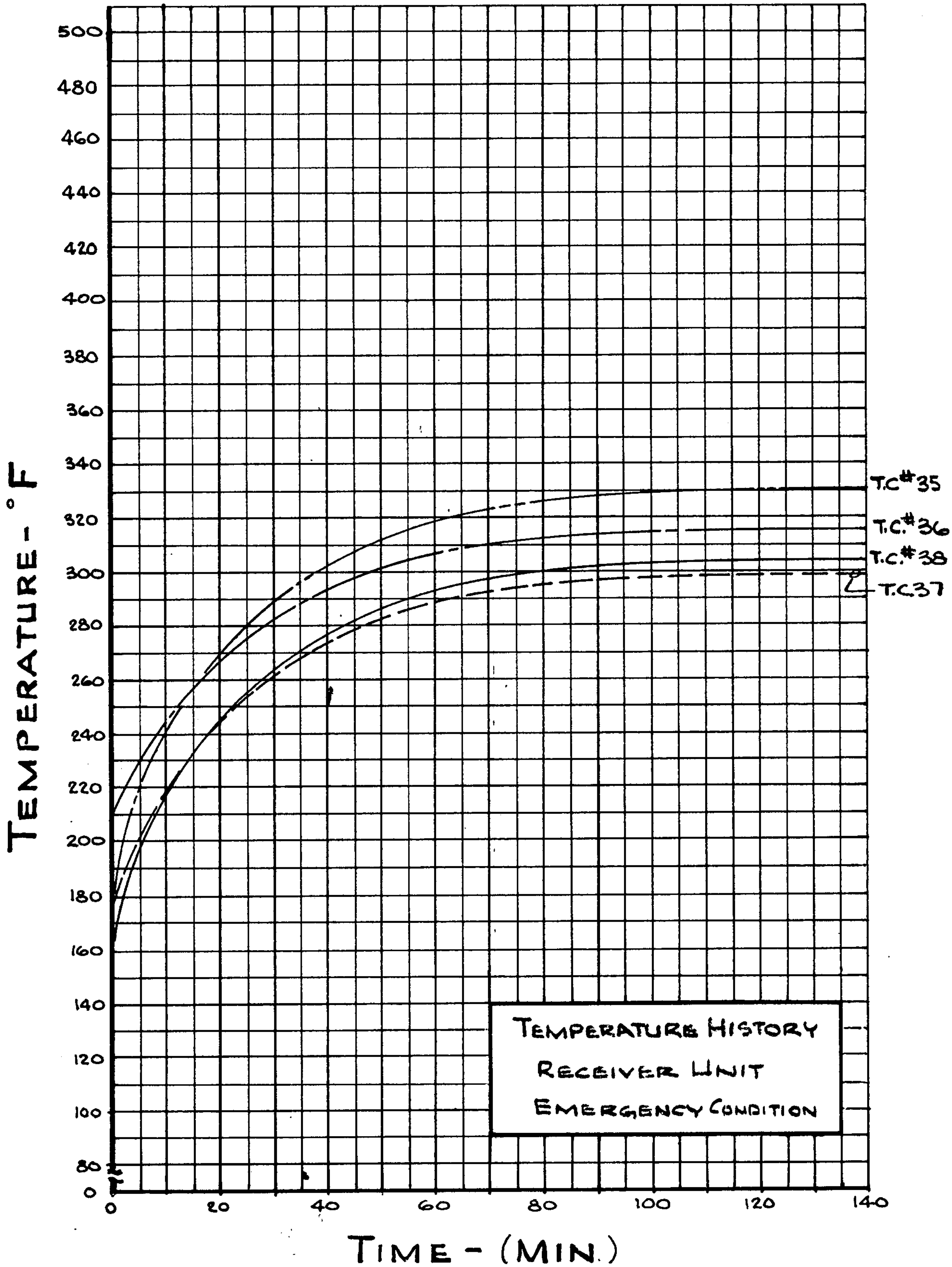

FIGURE Nº 44
(T.C. LOCATIONS FIG. Nº 4)

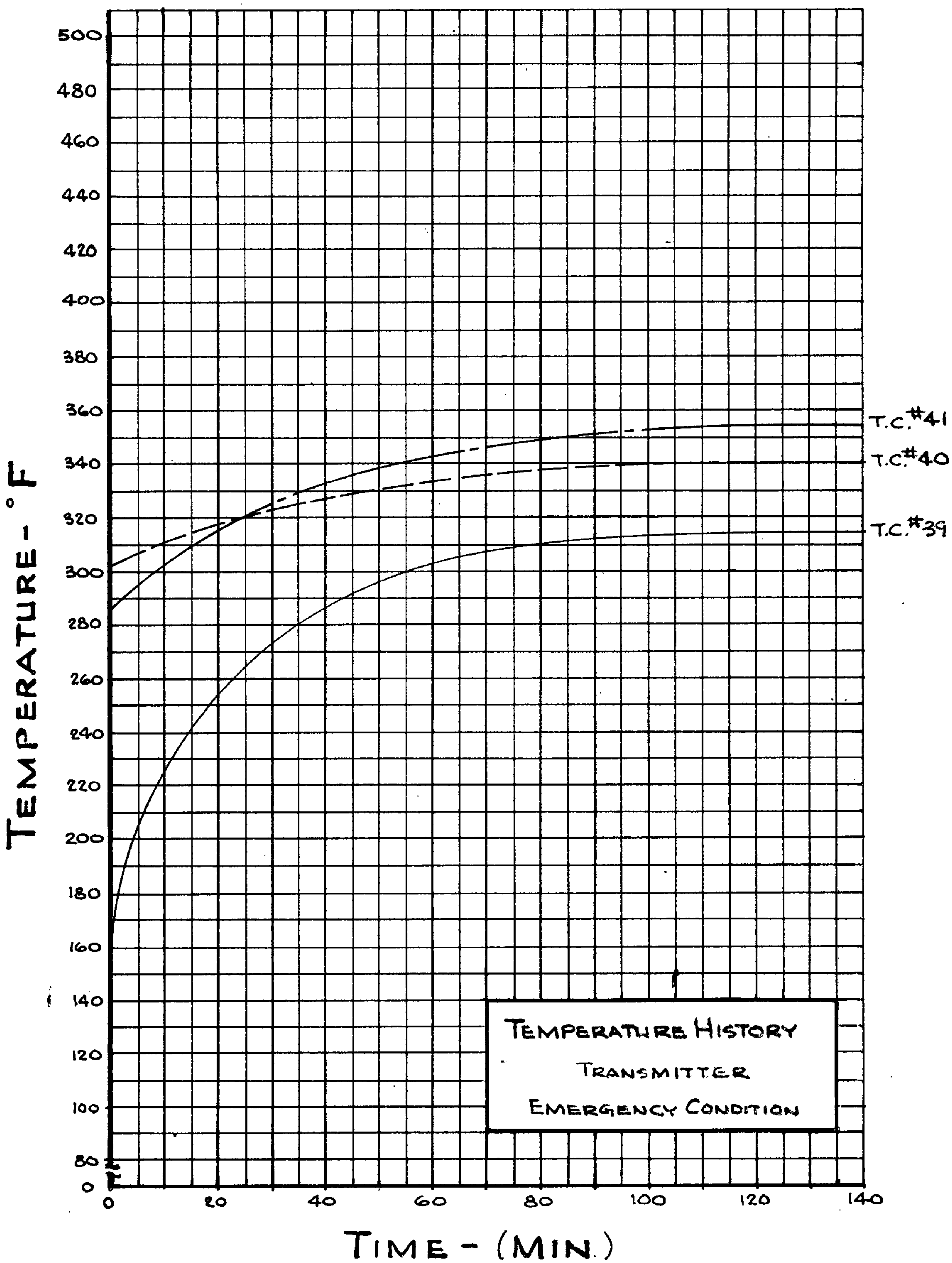

FIGURE Nº 45
(T.C. LOCATIONS FIG. Nº 5)

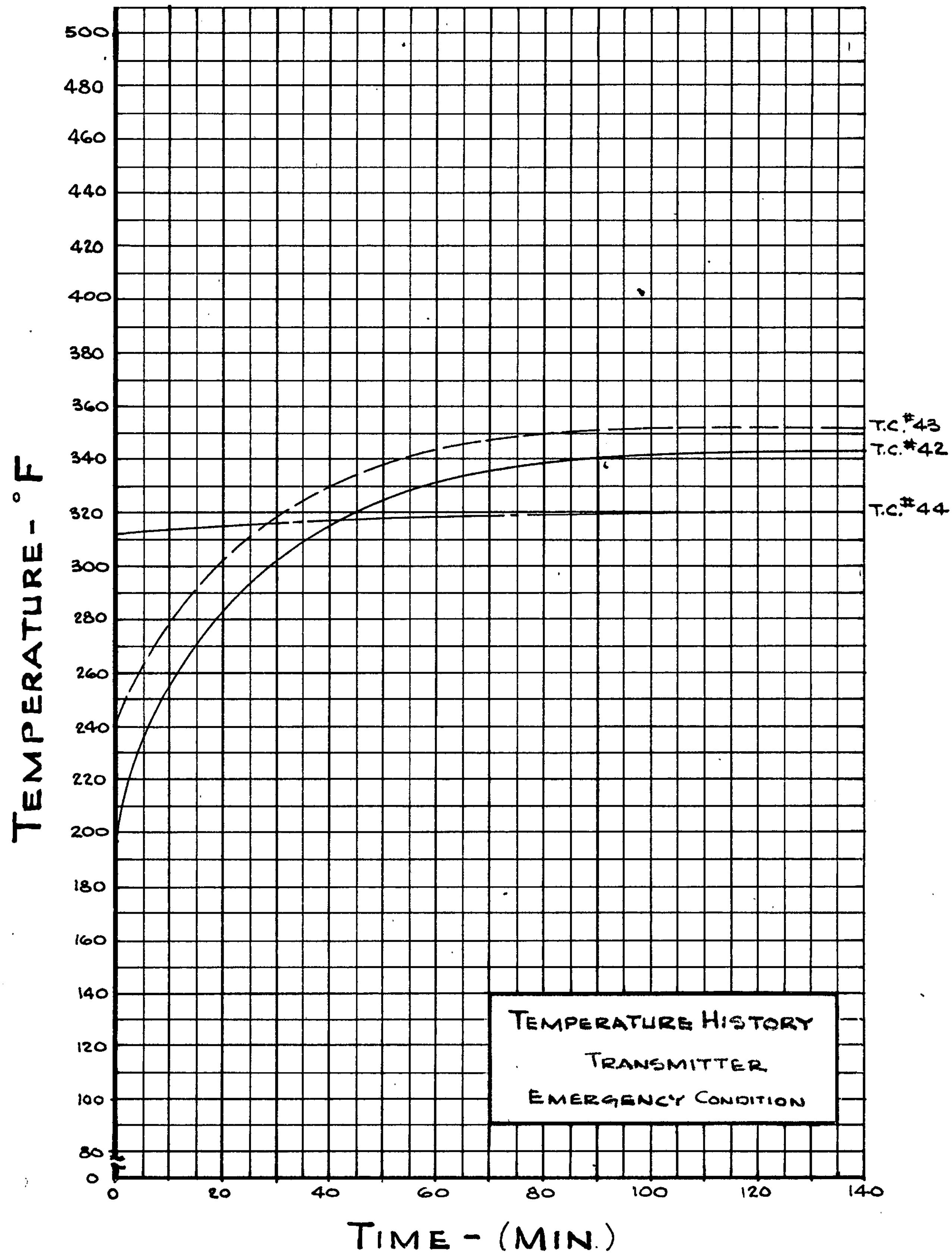

FIGURE Nº 46
(T.C. LOCATIONS FIG. Nº 5)

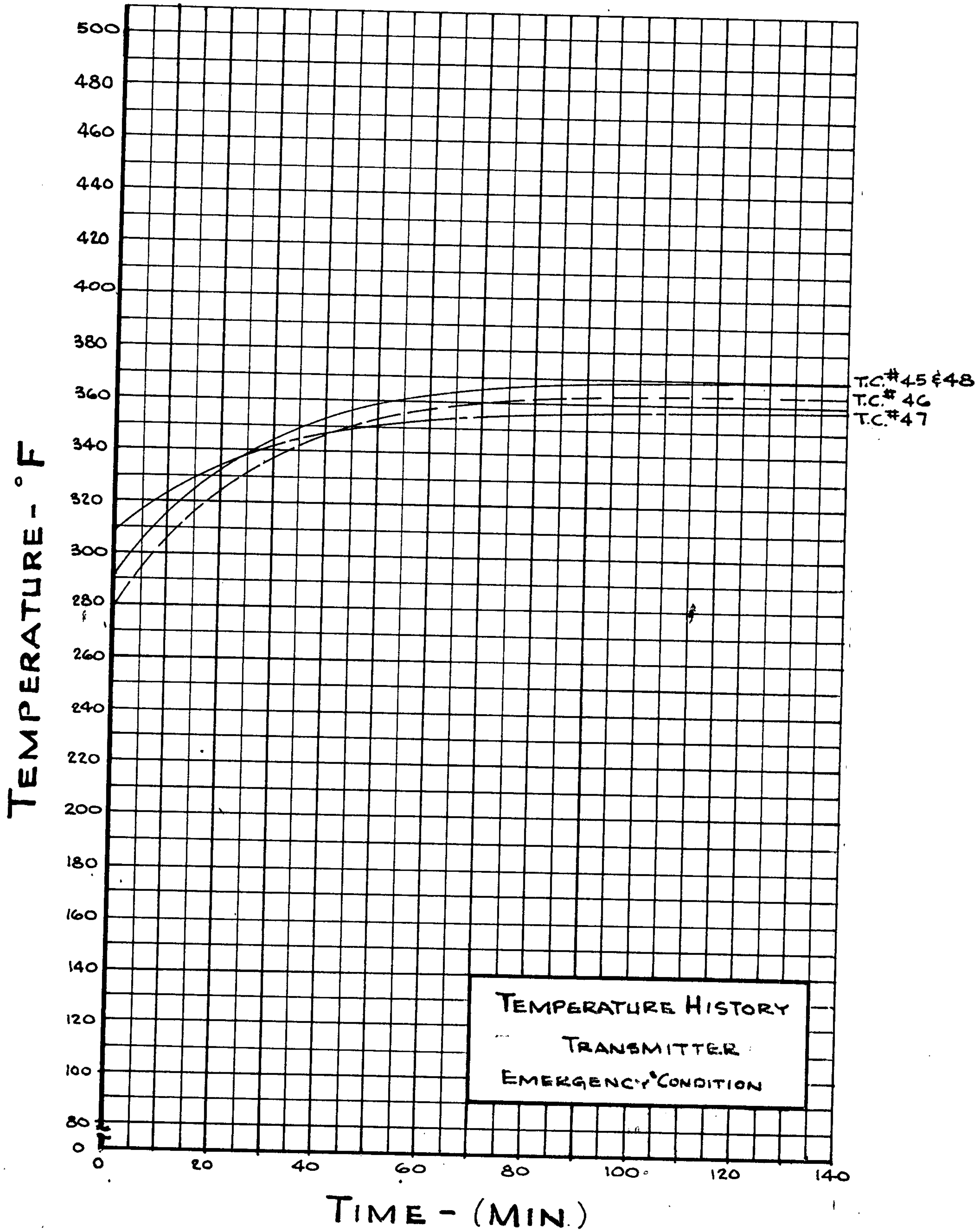

FIGURE Nº 47
(T.C. LOCATIONS FIG. Nº 5)

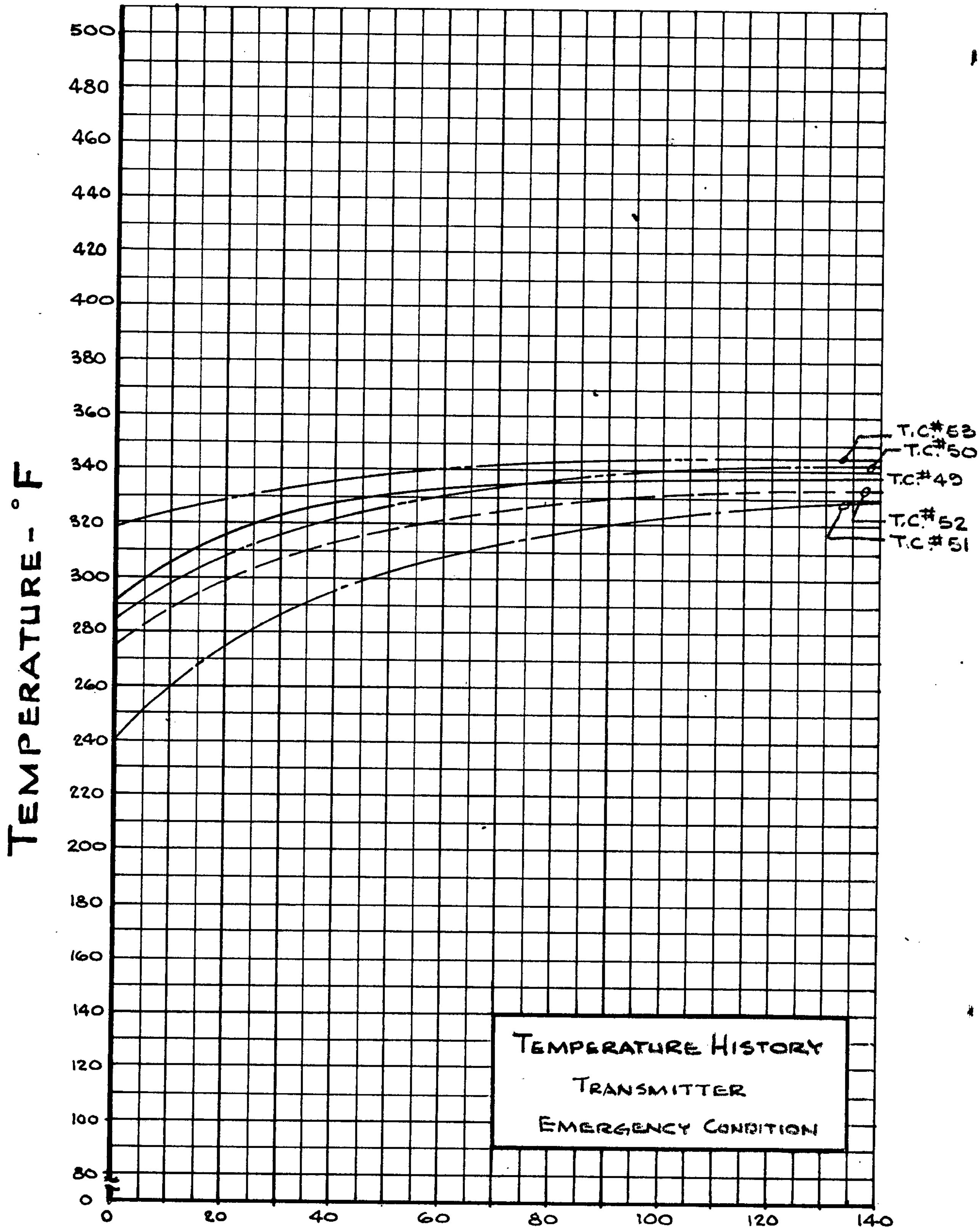

FIGURE № 48
(T.C. LOCATIONS FIG. № 5)

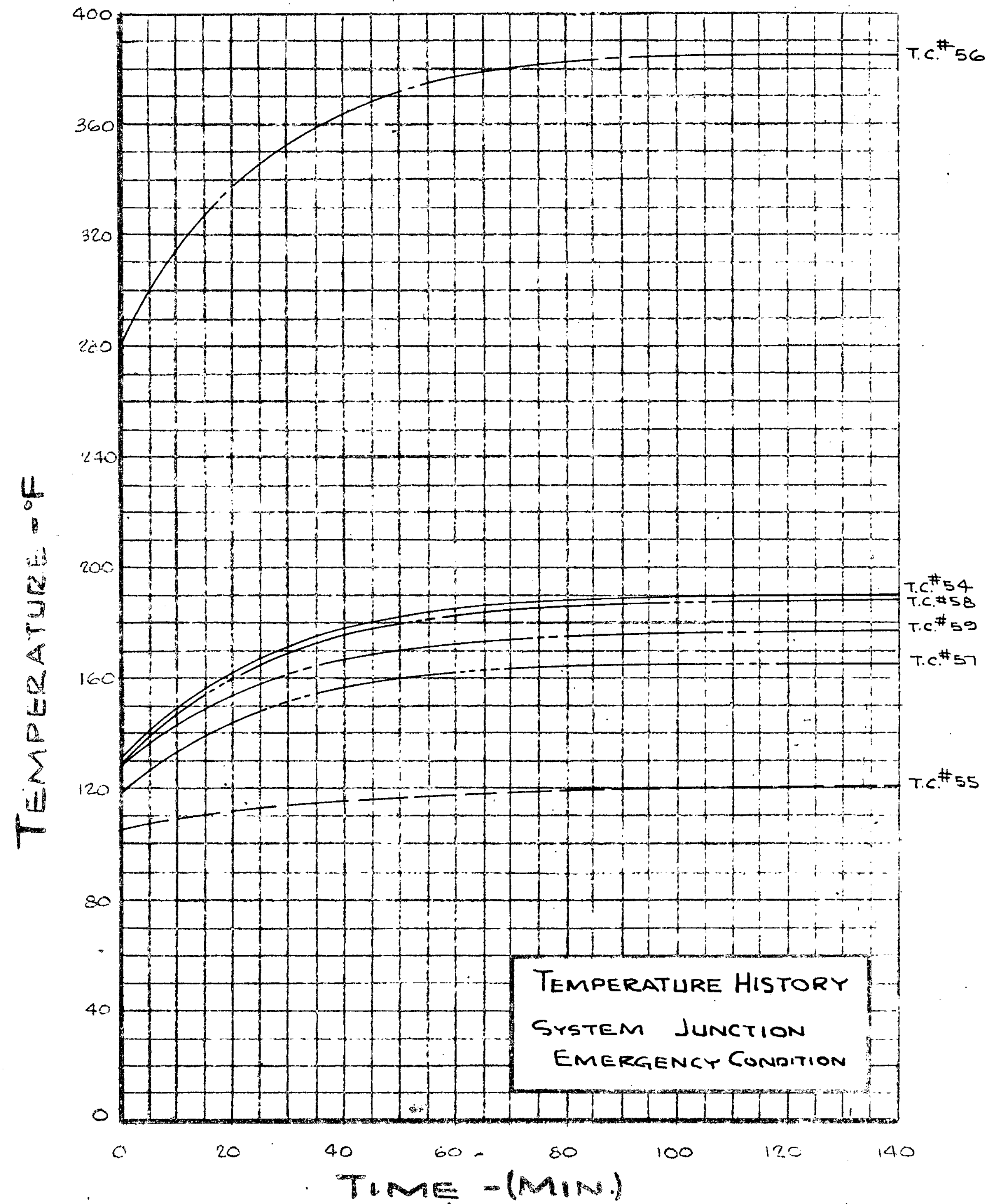

FIGURE Nº 49
(T.C. LOCATIONS FIG. Nº 6)

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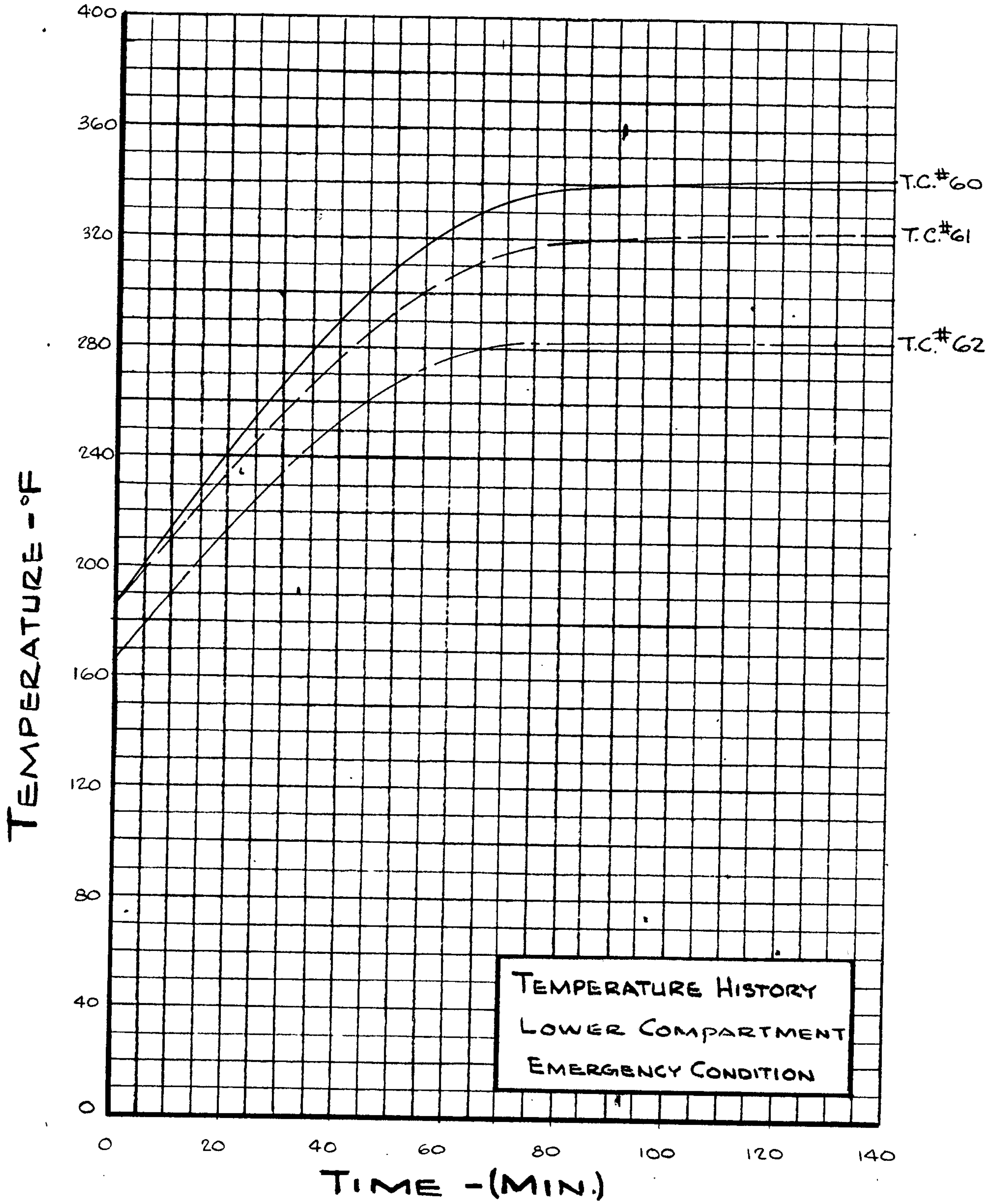

FIGURE Nº 50
(T.C. LOCATIONS FIG. Nº 7)

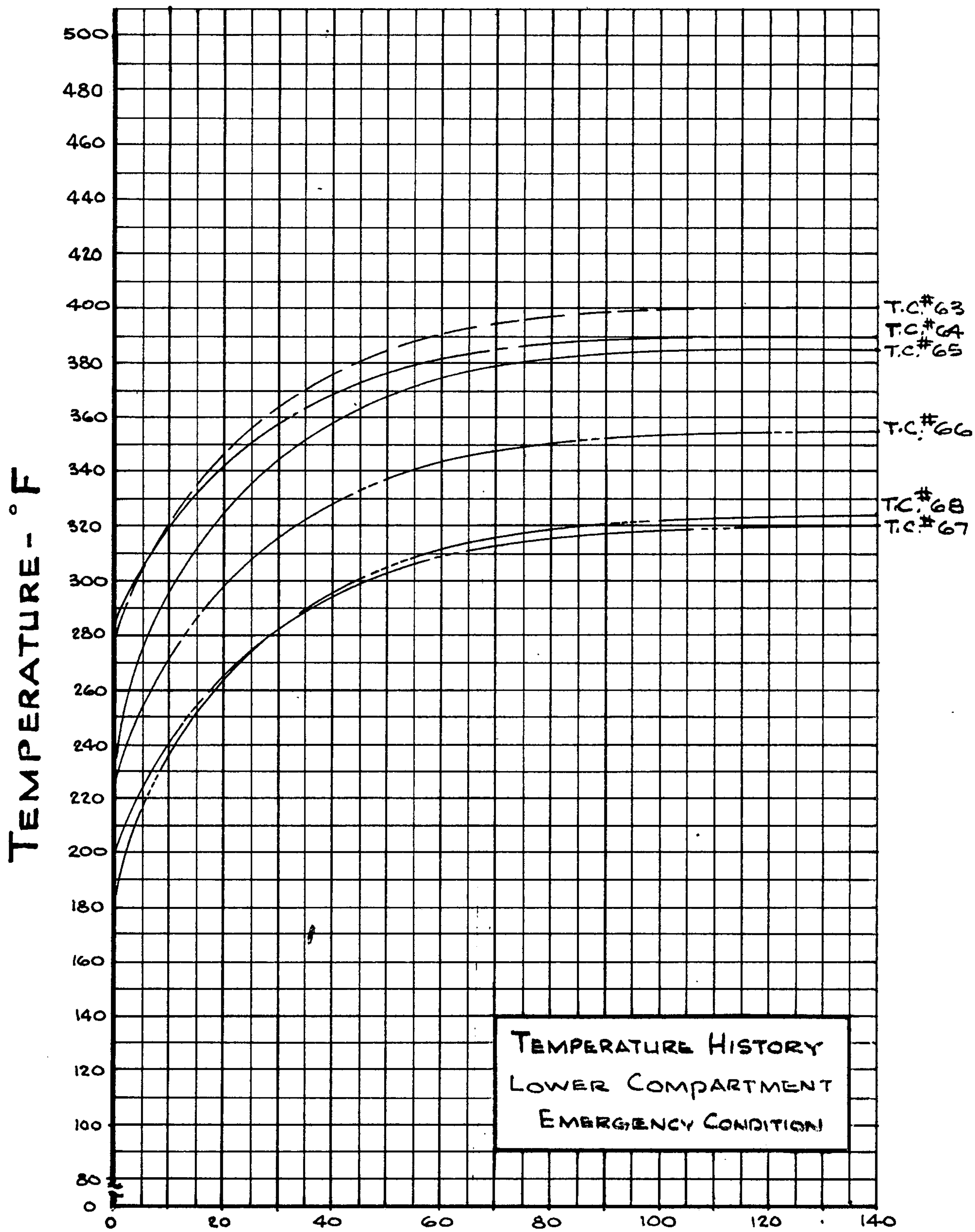

FIGURE Nº 51
(T.C. LOCATIONS FIG. Nº 7)

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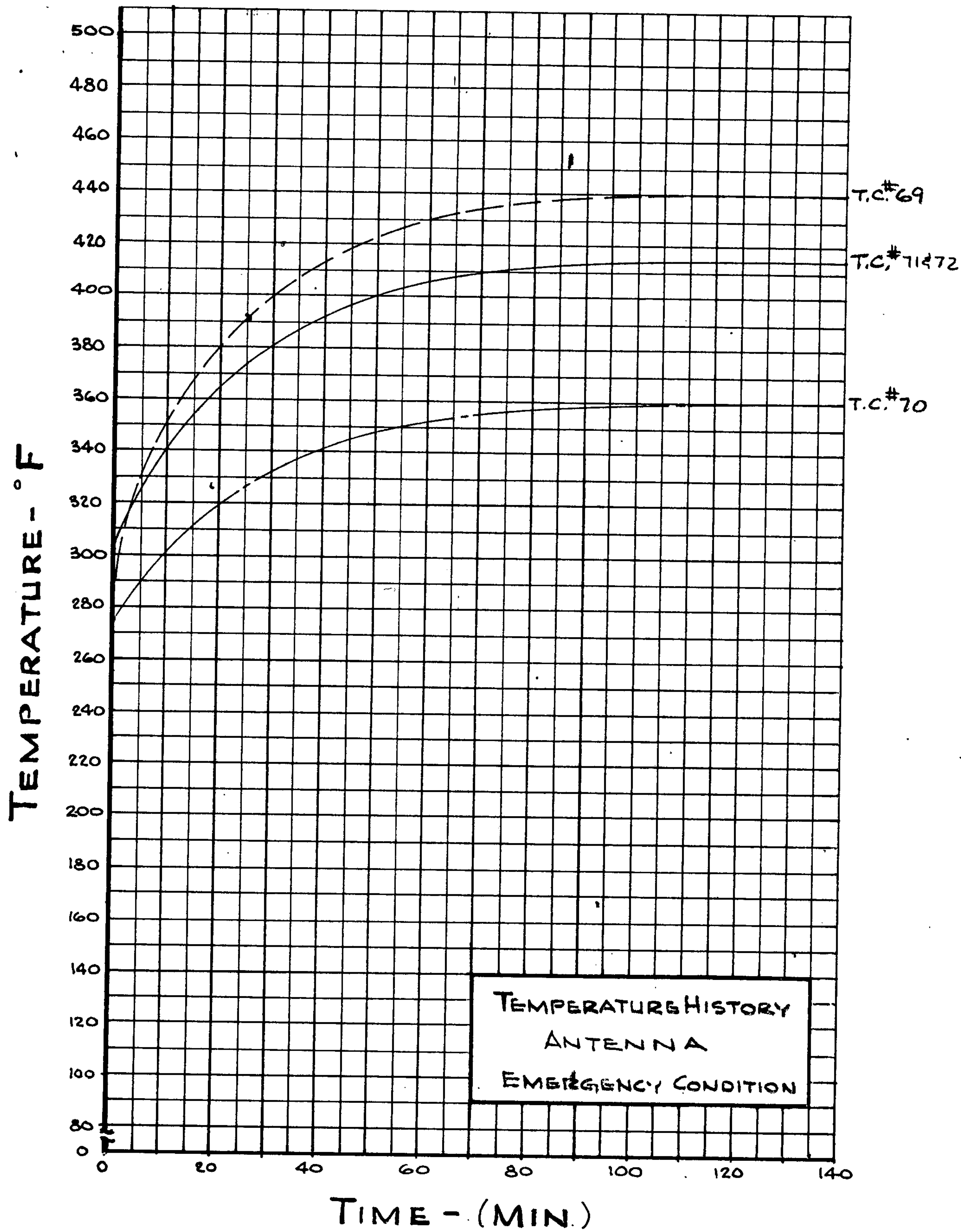


FIGURE Nº 52
(T.C. LOCATIONS FIG. Nº 7)

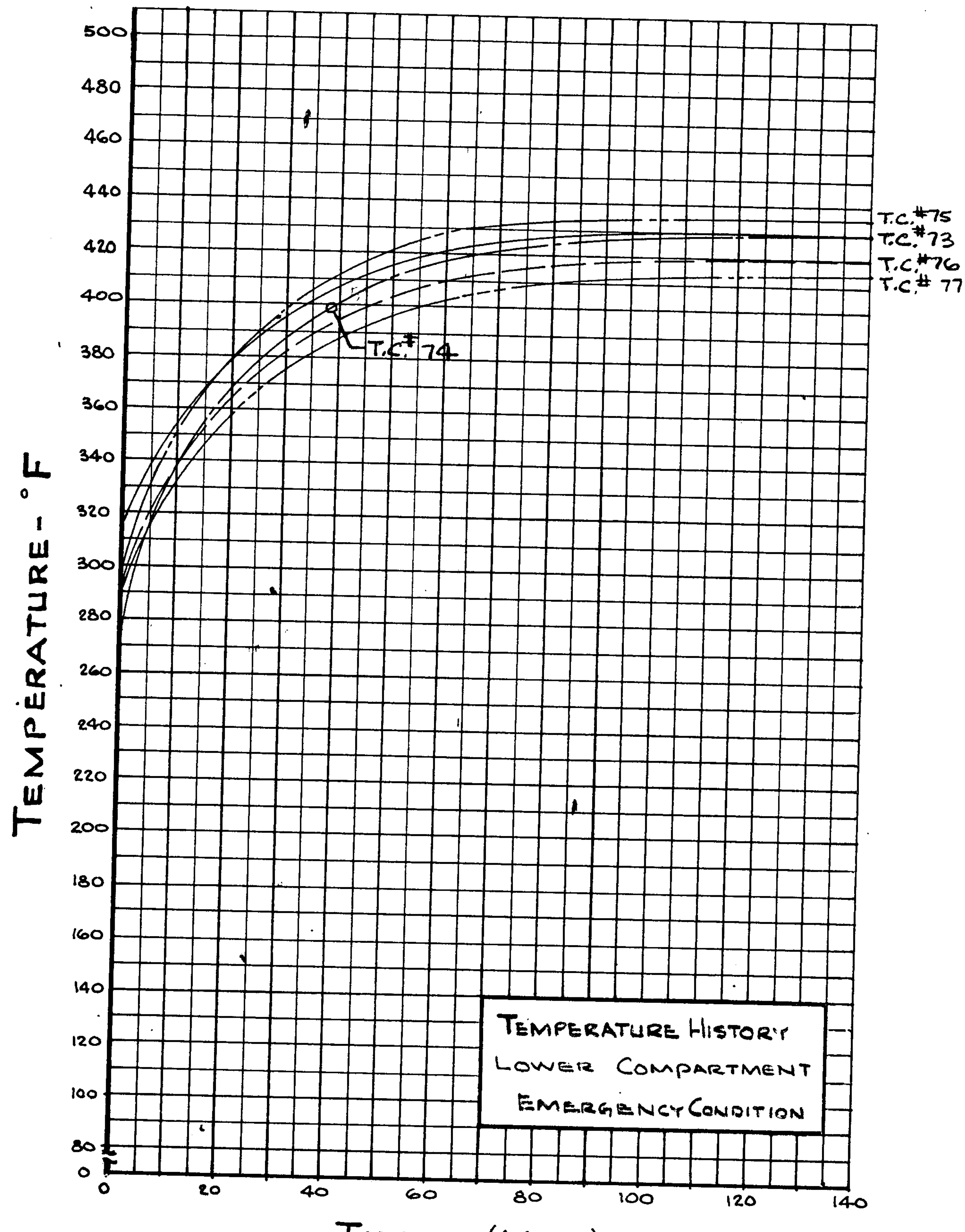


FIGURE Nº 53
(T.C. LOCATIONS FIG. Nº 7)

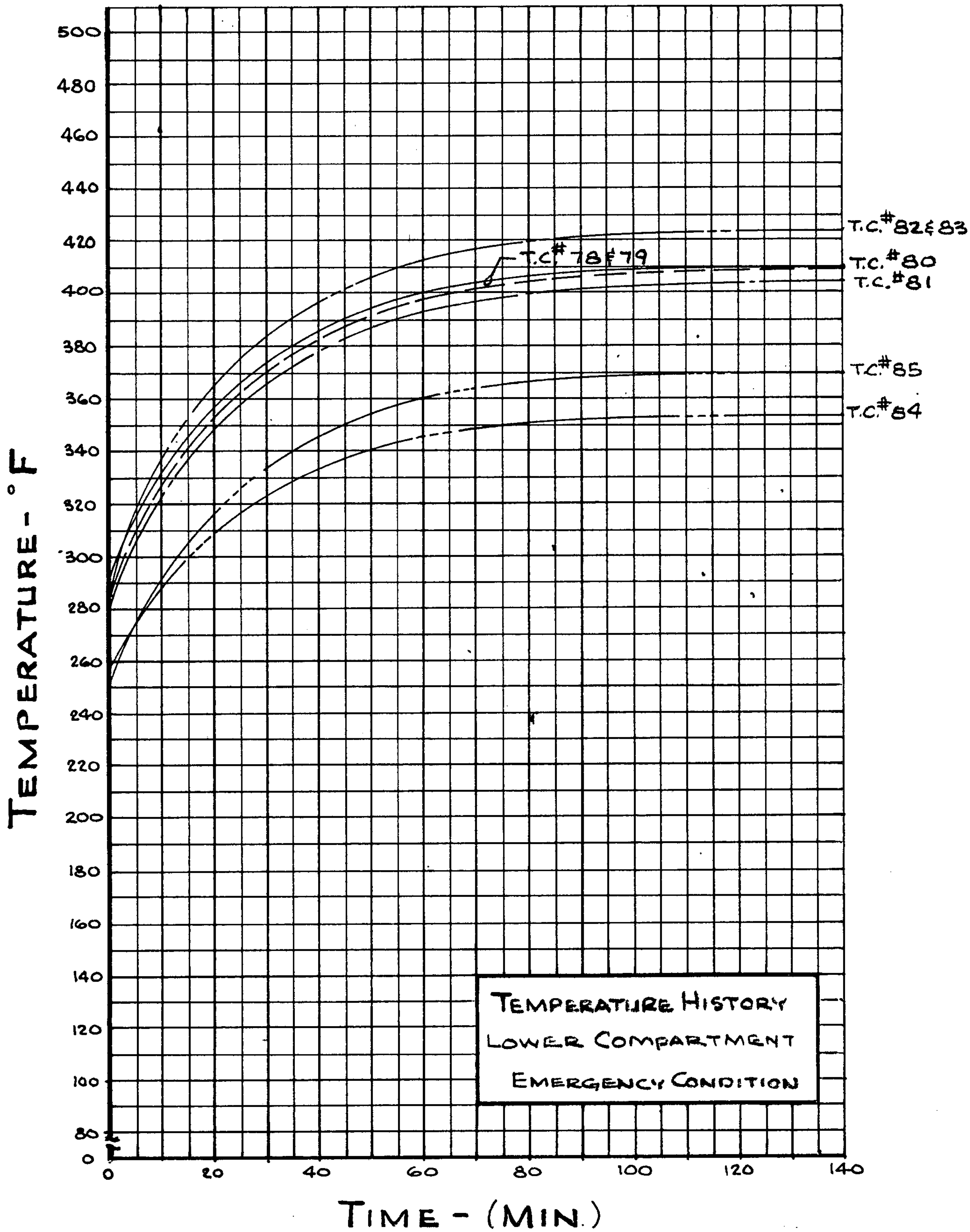


FIGURE Nº 54
(T.C. LOCATIONS FIG. Nº 7)

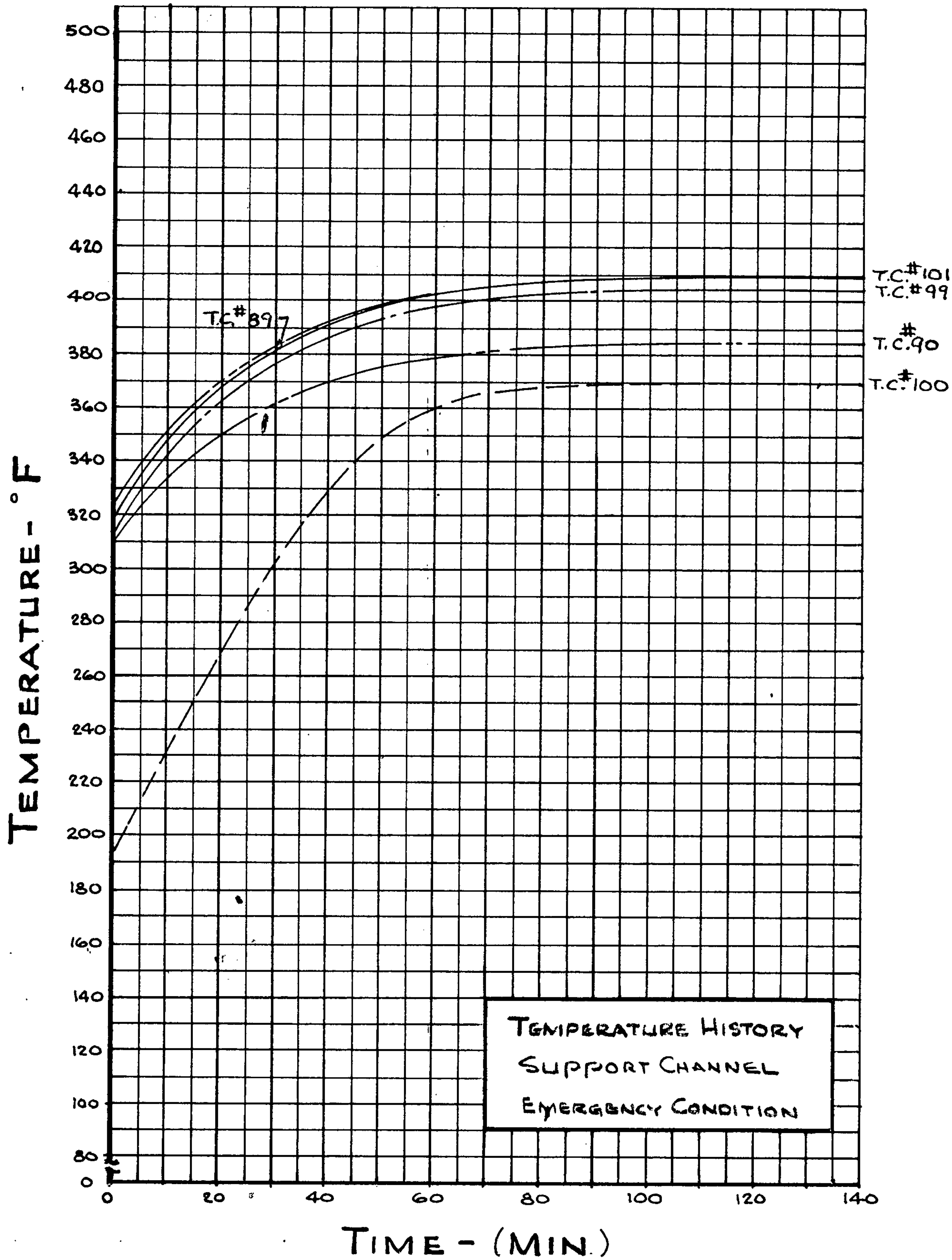


FIGURE Nº 55
(T.C. LOCATIONS FIG. Nº 7)

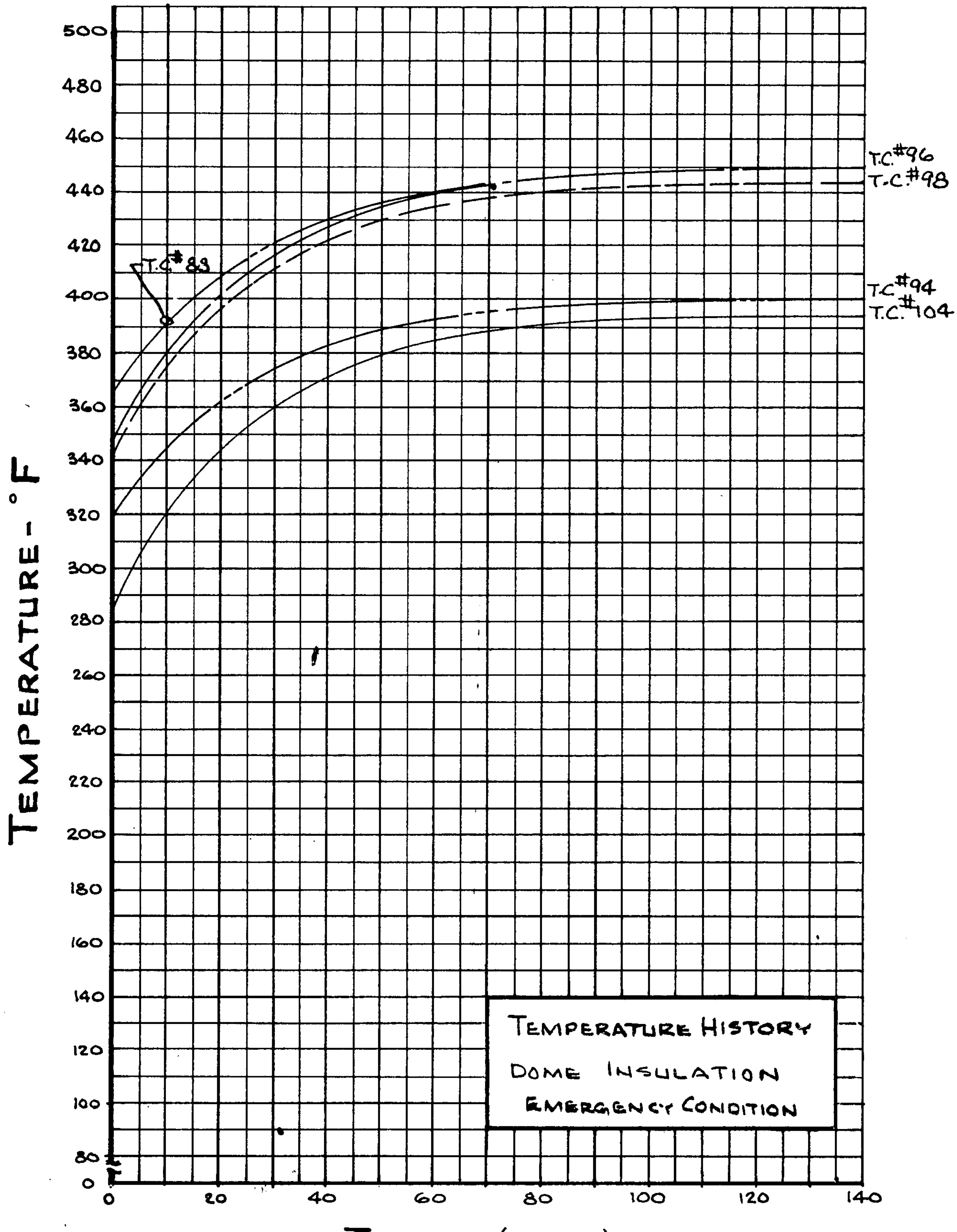


FIGURE Nº 56
(T.C. LOCATIONS FIG. Nº 7)

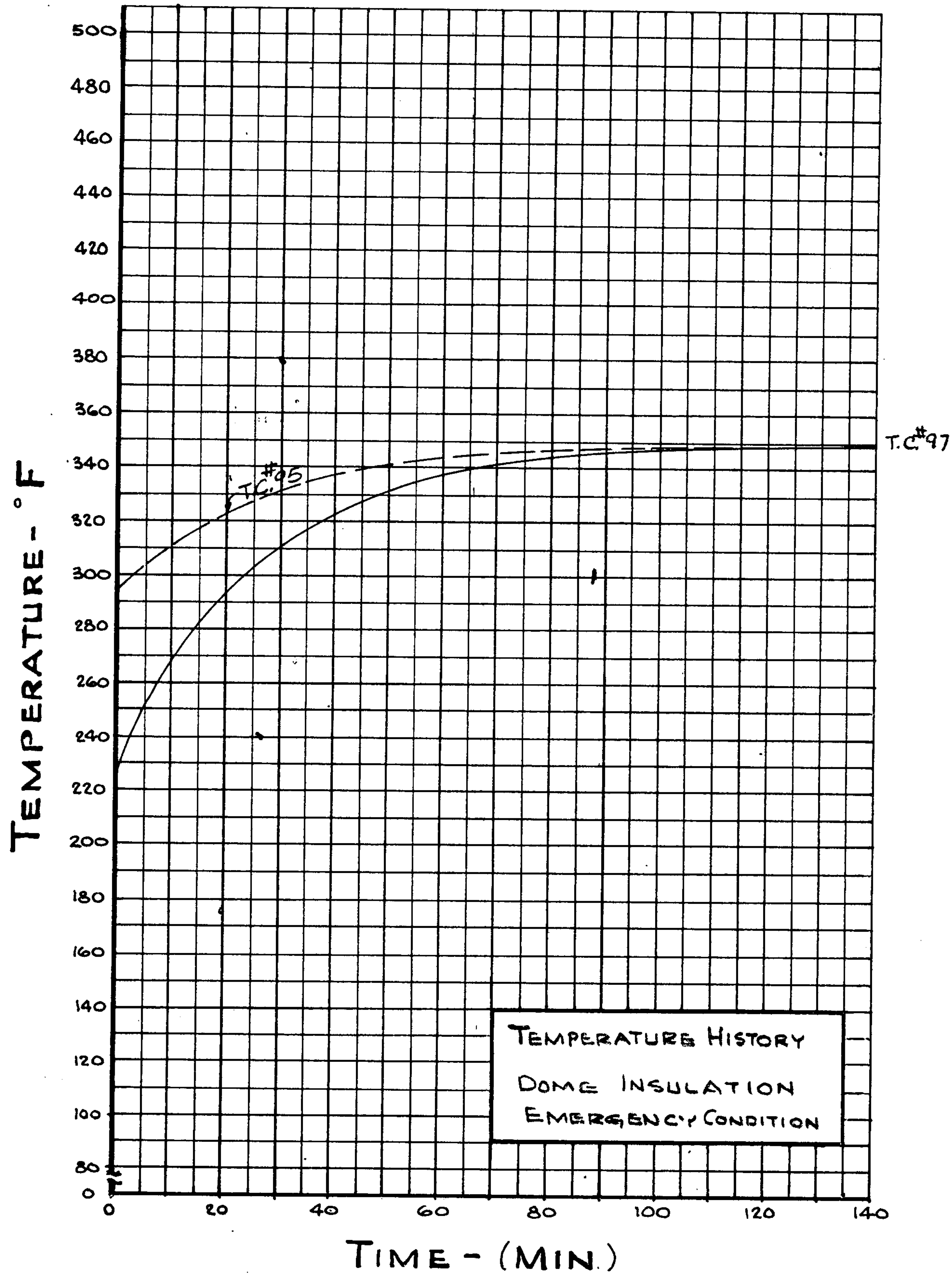


FIGURE Nº 57
(T.C. LOCATIONS FIG. Nº 7)

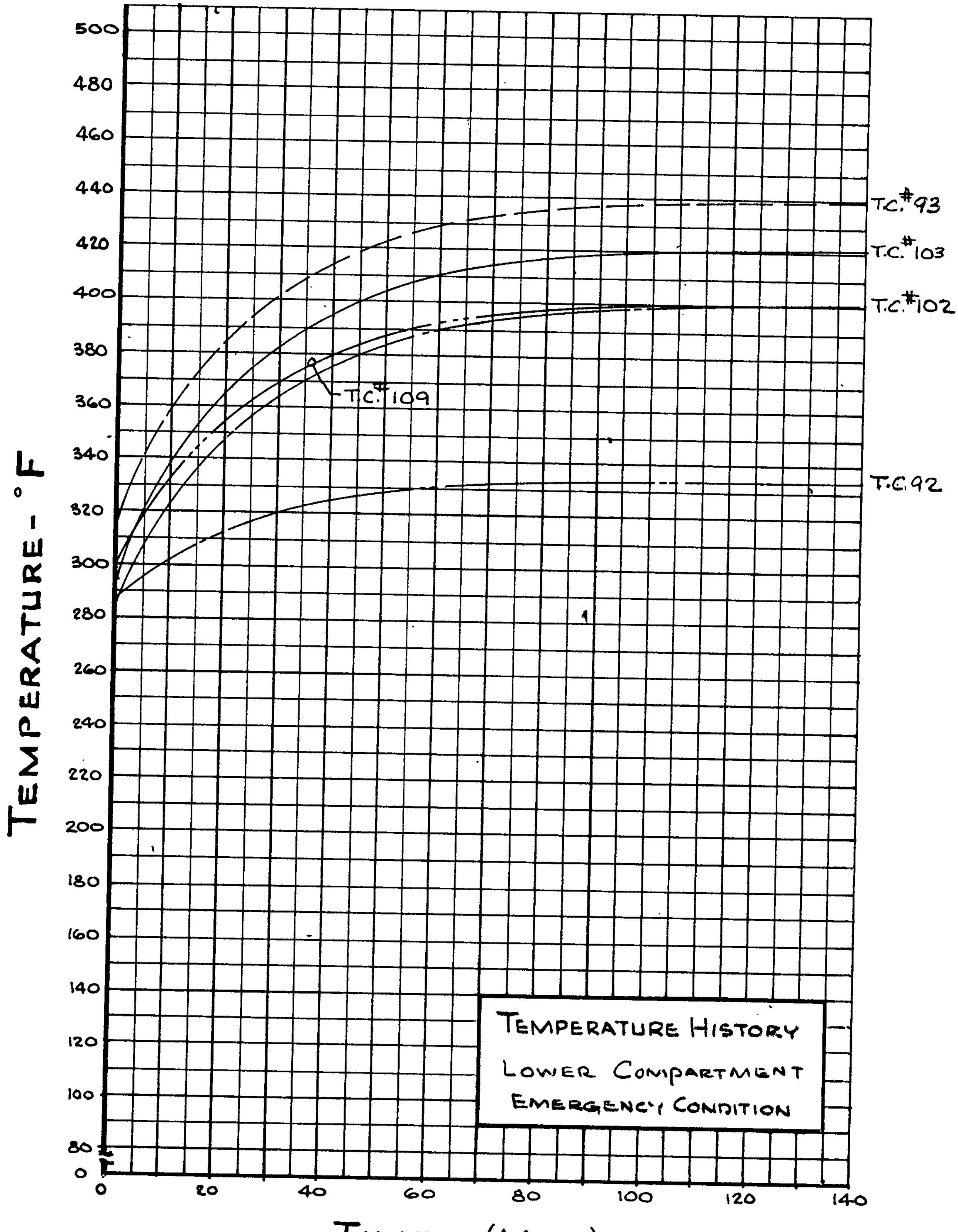


FIGURE Nº 58
(T.C. LOCATIONS FIG. Nº 7)

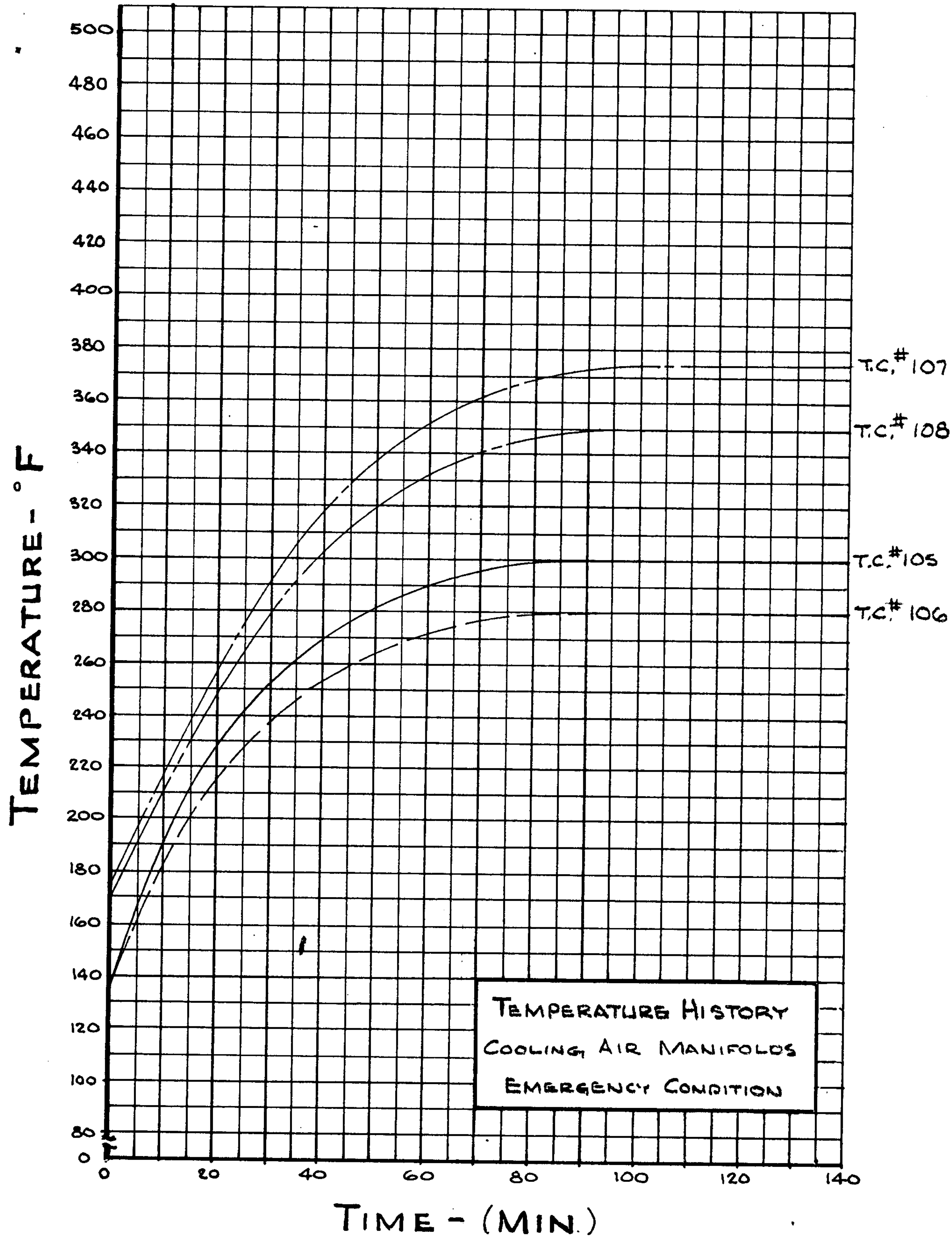
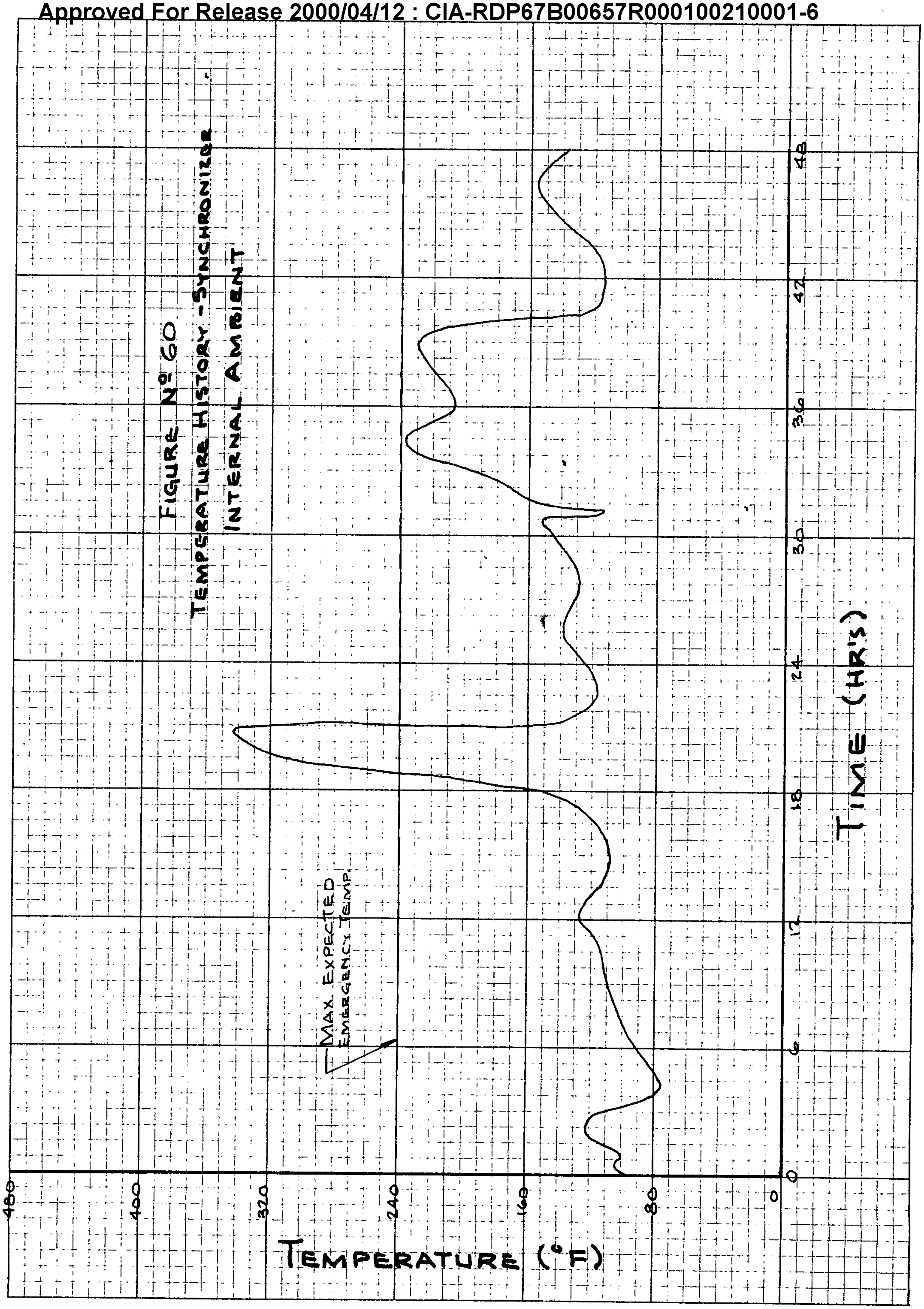


FIGURE Nº 59
(T.C. LOCATIONS FIG. Nº 7)



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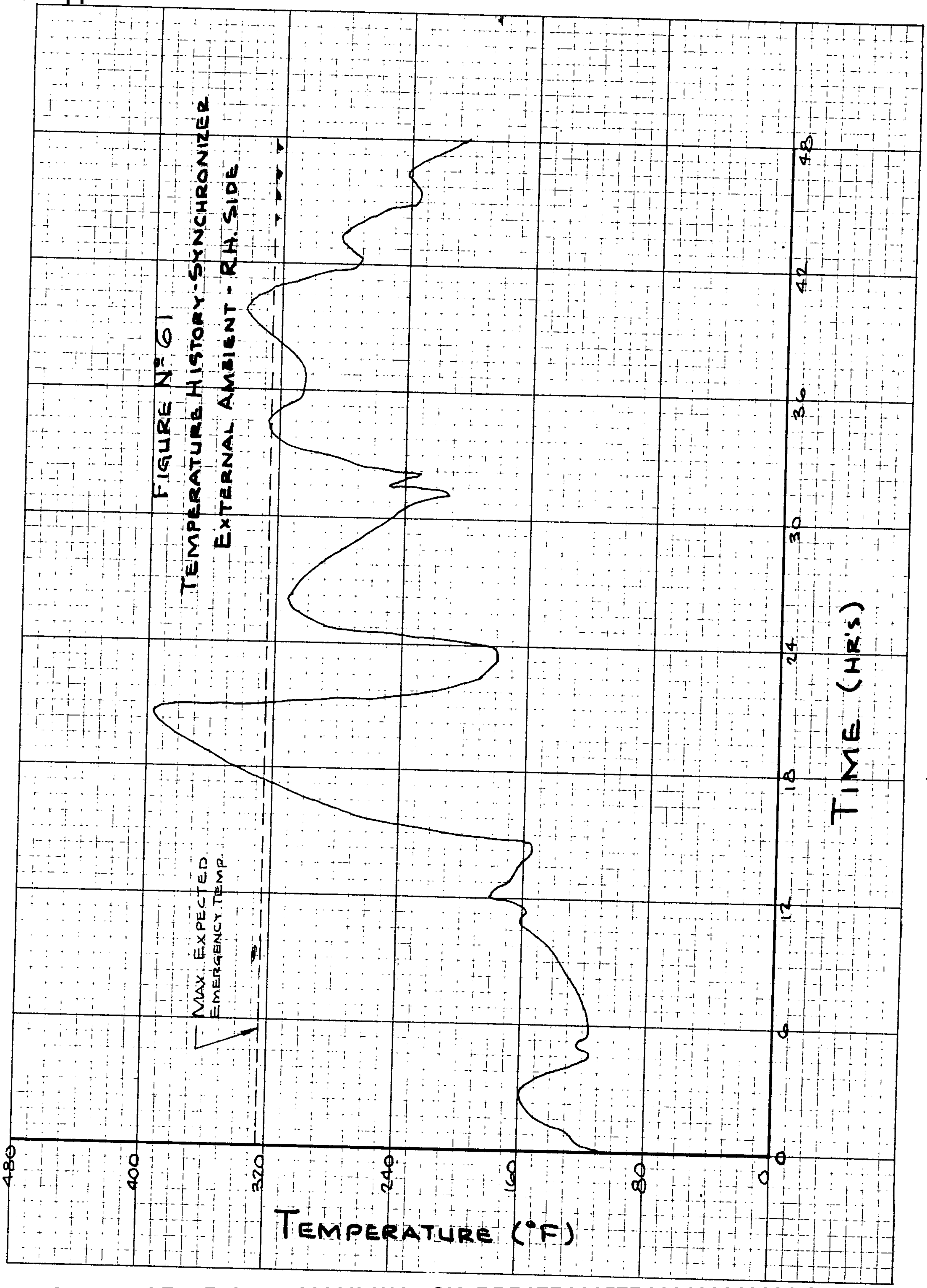
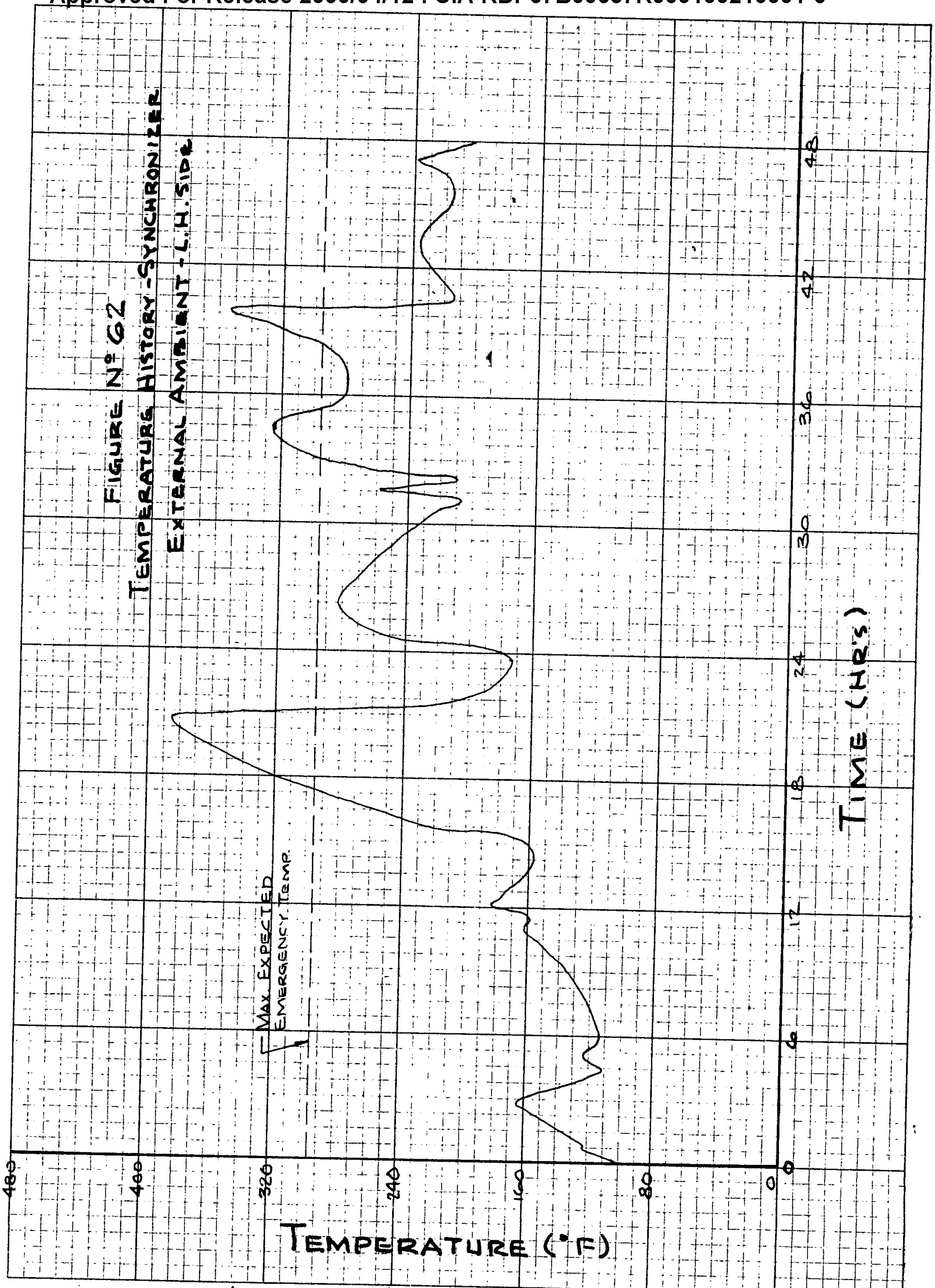


FIGURE No. 61
TEMPERATURE HISTORY - SYNCHRONIZER
EXTERNAL AMBIENT - R.H. SIDE
MAX. EXPECTED
EMERGENCY TEMP.
TIME (HR'S)
0
6
12
18
24
30
36
42
48
TEMPERATURE (°F)
480
400
320
240
160
80
0



Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

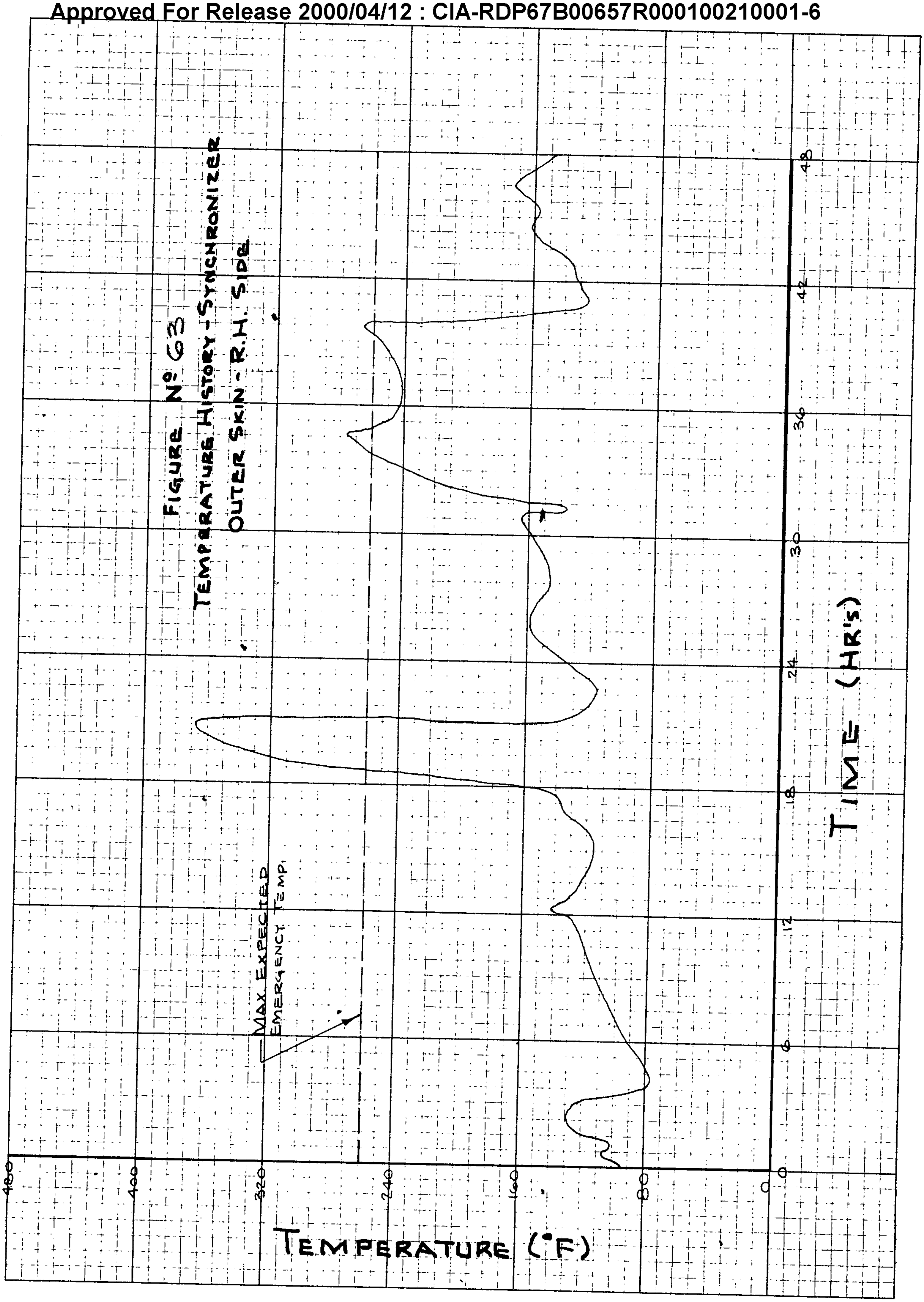


FIGURE No 63
TEMPERATURE HISTORY - SYNCHRONIZER
OUTER SKIN - R.H. SIDE
MAX. EXPECTED
EMERGENCY TEMP.
0
6
12
18
24
30
36
42
48
TIME (HR's)
480
400
320
240
160
80
0
TEMPERATURE (°F)

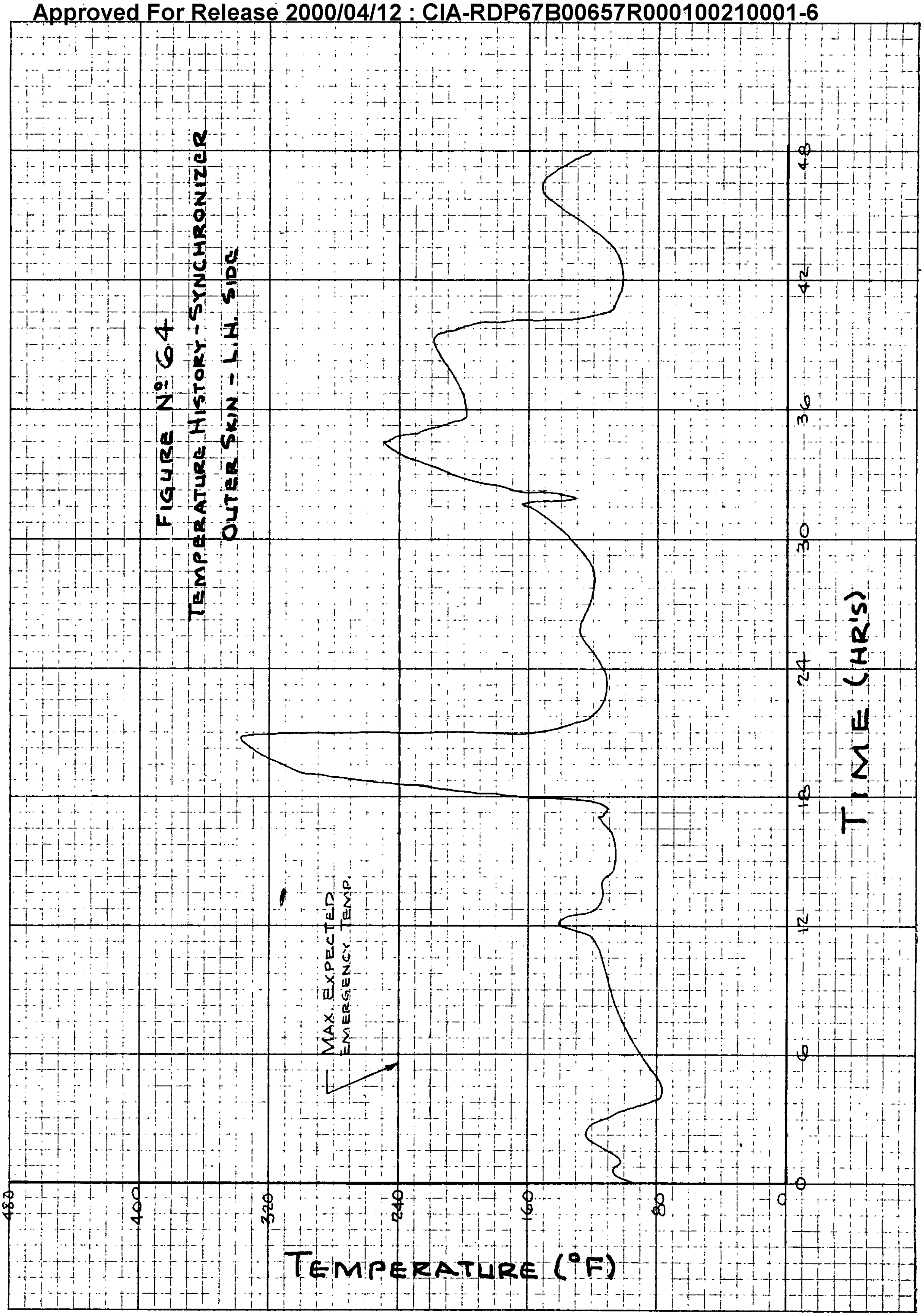


FIGURE Nº 64
TEMPERATURE HISTORY - SYNCHRONIZER
OUTER SKIN - L.H. SIDE
MAX. EXPECTED
EMERGENCY TEMP.
TIME (HR'S)
0
6
12
18
24
30
36
42
48
TEMPERATURE (°F)
480
400
320
240
160
80
0

SECTION E

CONCLUSIONS

Results of the thermal test conducted on the KP-I Radar Equipment indicate that the operation of radar equipment should not be adversely affected under normal vehicle operation.

A cooling air flow rate of 8.5 lb/min. @ 80°F through the upper compartment appears adequate to maintain unit internal ambient temperatures and surrounding air temperatures for equipment operation. Test results indicate that component temperatures will be maintained below the component specification limits.

Data indicates that temperatures found within the Antenna Control, Synchronizer and Receiver Units will be below 170°F during the operating mode. Components used in these units generally have a specified upper ambient temperature limit of 85°C (185°F). The Transmitter Unit experienced somewhat higher temperatures but no temperature problems are anticipated with this unit. Components used have rated temperature limits far in excess of measured values.

Component temperatures monitored in the lower compartment show that no major problems should exist when operating under normal conditions (W_2 = 1.5 lb/min). Temperature of the Antenna array is at 290°F which is 35°F less than the specified limits. Temperature sensitive components such as the vertical gyroscope, azimuth gyroscope and accelerometer were also maintained at an acceptable level (less than 185°F).

Results of the vehicle emergency tests indicate that no serious problems should be expected during short duration emergency conditions. Temperatures reached in 30-40 minutes at emergency conditions are generally below the temperature limits specified for 40 minutes exposure. In some cases emergency temperatures exceeded component specifications. It is felt however, that the short duration for which the emergency condition prevailed should not cause component failure or reduce system reliability appreciably in most instances.

This fact is further evidenced by the results of temperature testing on the Synchronizer Unit. Control of cooling air temperature and flow was not adequately maintained during test No. 3. Ambient air temperatures within the Unit reached 343°F (Figure No. 60) during this vehicle emergency test. This temperature was approximately 103°F higher than should be encountered during vehicle emergency conditions (see Figure No. 40). Post test inspection of the Synchronizer Unit uncovered no catastrophic component failures.

A performance check at GAC subsequent to the thermal test showed that no additional electrical problems had occurred after the functional test (during Run #2). Exposure to the emergency tests and the temperature cycling as shown in Figures 61-64 caused no damage.

The two electrical problems encountered in the Synchronizer Unit during the operating portion of the tests can be attributed to a temperature sensitive circuit (film drive circuit) and a faulty component. The film drive circuit is being modified to alleviate temperature problems. The

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bandpass filter that caused a malfunction in the clutterlock circuit was a substandard part used in the engineering model and did not meet the environmental specifications imposed upon system components. It is felt that this component exhibited a short circuit during the operating test, Run #2, and burst during subsequent emergency conditions. It should be noted that schedule considerations and component availability made it necessary to use substandard or substitute components in some cases.

Mechanical problems noted in the Synchronizer Unit were minor and resulted both from use of substandard materials and exposure to unrealistic temperature conditions. External ambient temperatures surrounding the Synchronizer Unit exceeded actual expected values by 90°F. This resulted in oxidation of the irridite finish on the box and the melting of solder in the external cable connectors. Actual temperature values will not be sufficient to melt solder or to destroy the finishes on production units. These units will be coated with a white conversion coating capable of withstanding the temperatures encountered during vehicle emergency conditions. The split sleeving noted in the post test inspection is attributable to the use of low temperature vinyl material. High temperature materials are specified for production units.

Emergency temperatures for the accelerometer, vertical gyroscope, and azimuth gyroscope (Figure No. 50) indicate possible damage could occur even when subjected to emergency conditions for short durations (30-40 minutes). It is felt that the present cooling air flow is not sufficient to maintain these components to acceptable levels or assure maximum reliability.

Examination of the feasibility of component modification is suggested. It is felt that a component specification limit of 250°F would offer a higher degree of system reliability.

It has been observed that heat pickup by cooling air in the cooling air ducts and manifolds is appreciable. For instance, the cooling air temperature rise between the assembly inlet and the Synchronizer Unit is 10°F. The temperature rise between the Synchronizer exhaust and Receiver inlet is 14°F. These temperature rises signify loads of 360 and 500 watts respectively. In view of this, it is suggested that cooling ducts and manifolds be insulated where possible. It should be noted that care was taken in assuring that the ducts were not in thermal contact with the dome insulation. Heat pickup on the whole was from ambient conditions around the ducts.

It should be noted that the failure or rupture of the Antenna Control Unit is not indicative of structural or manufacturing inadequacies. The unit in question was a mockup and was not fabricated to the stringent manufacturing standards nor subject to the quality assurance provisions as required for production units.

APPENDIX

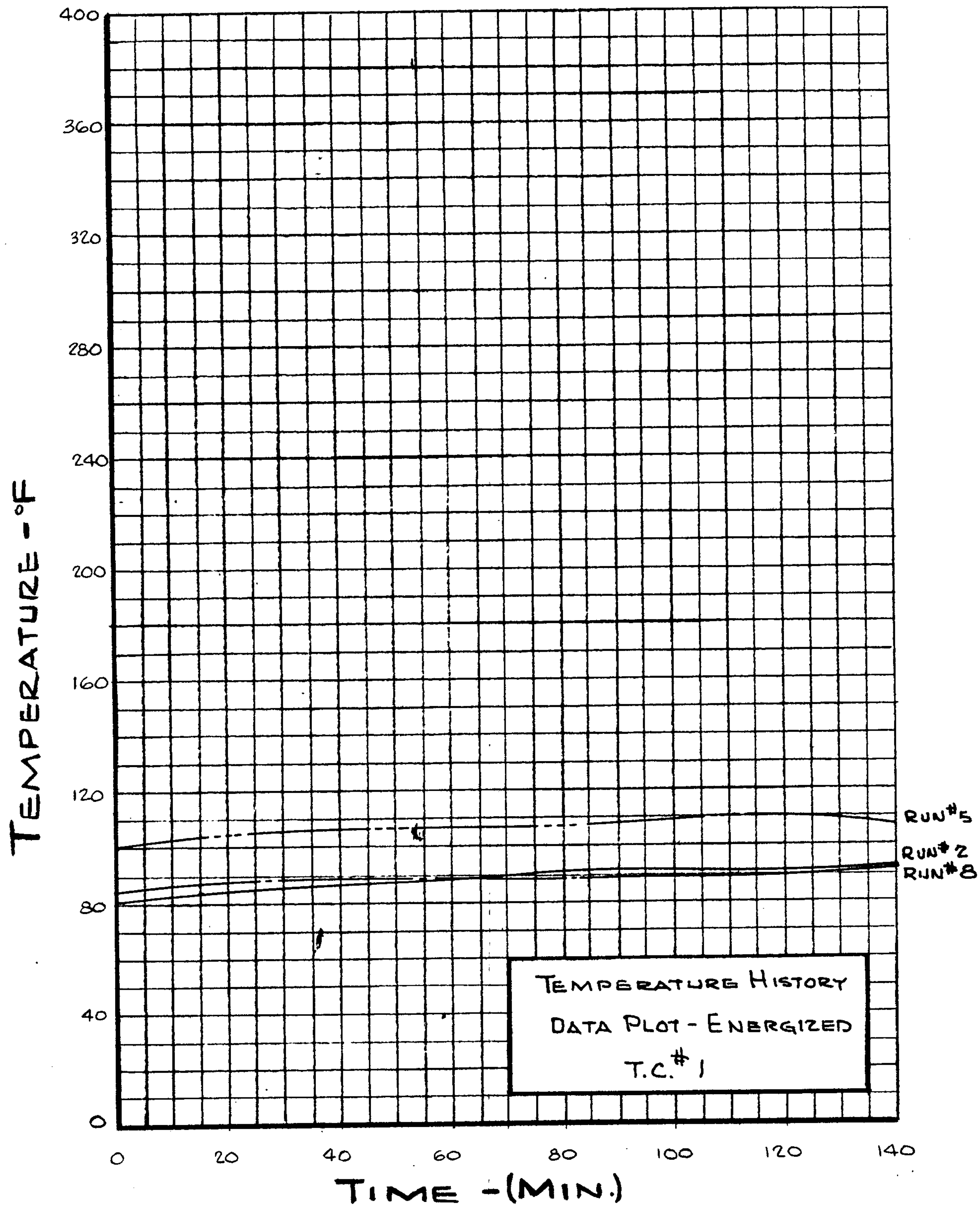
TEST DATA AND ILLUSTRATIONS

APPENDIX

Con't

APPENDIX

Con't



400
360
320
280
240
200
160
120
80
40
0
TEMPERATURE - °F
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN#5
RUN#2
RUN#8
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C.# 1

FIGURE Nº A1

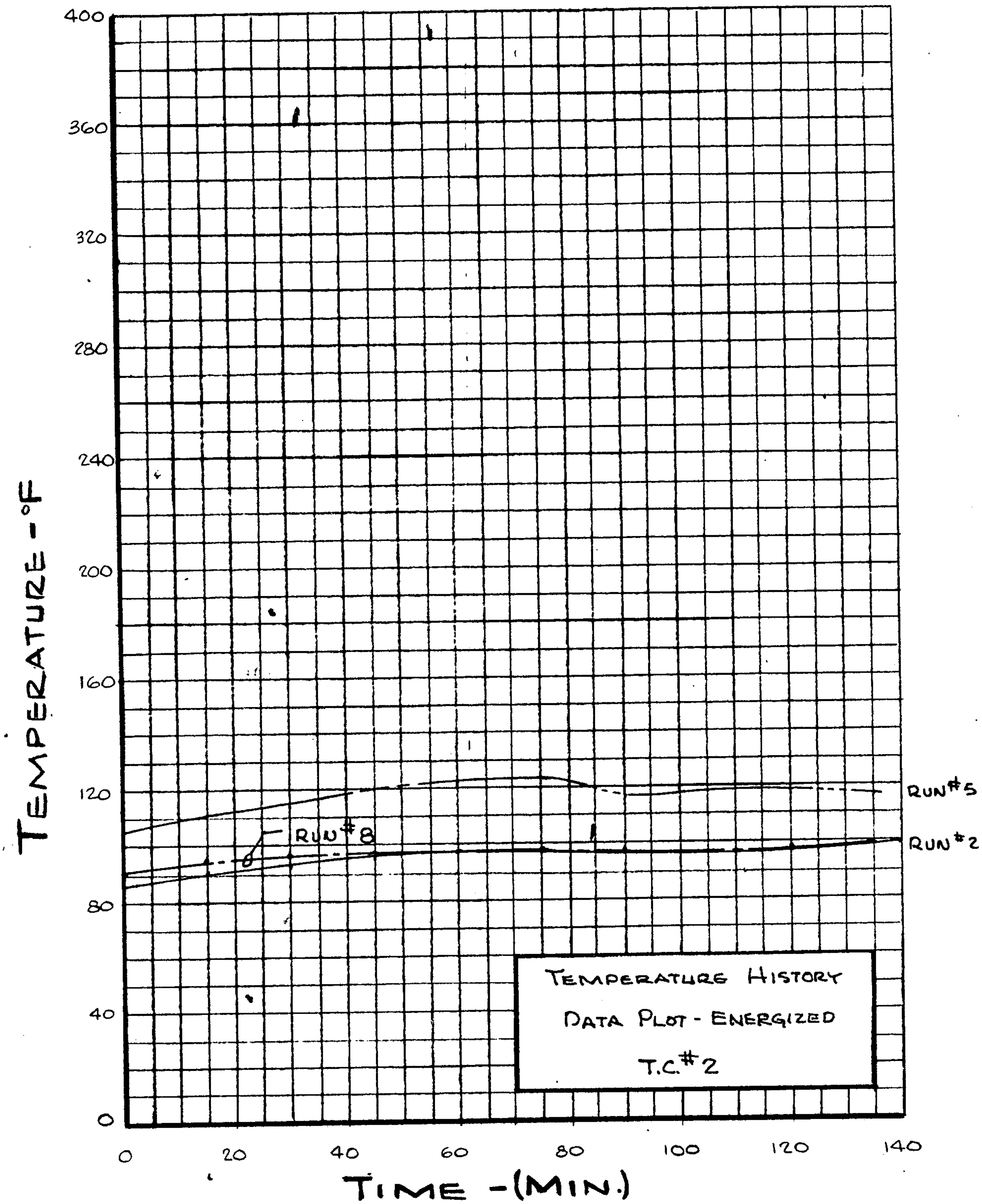

400
360
320
280
240
200
160
120
80
40
0
TEMPERATURE - °F
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN #5
RUN #2
RUN #8
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C. #2

FIGURE Nº A2

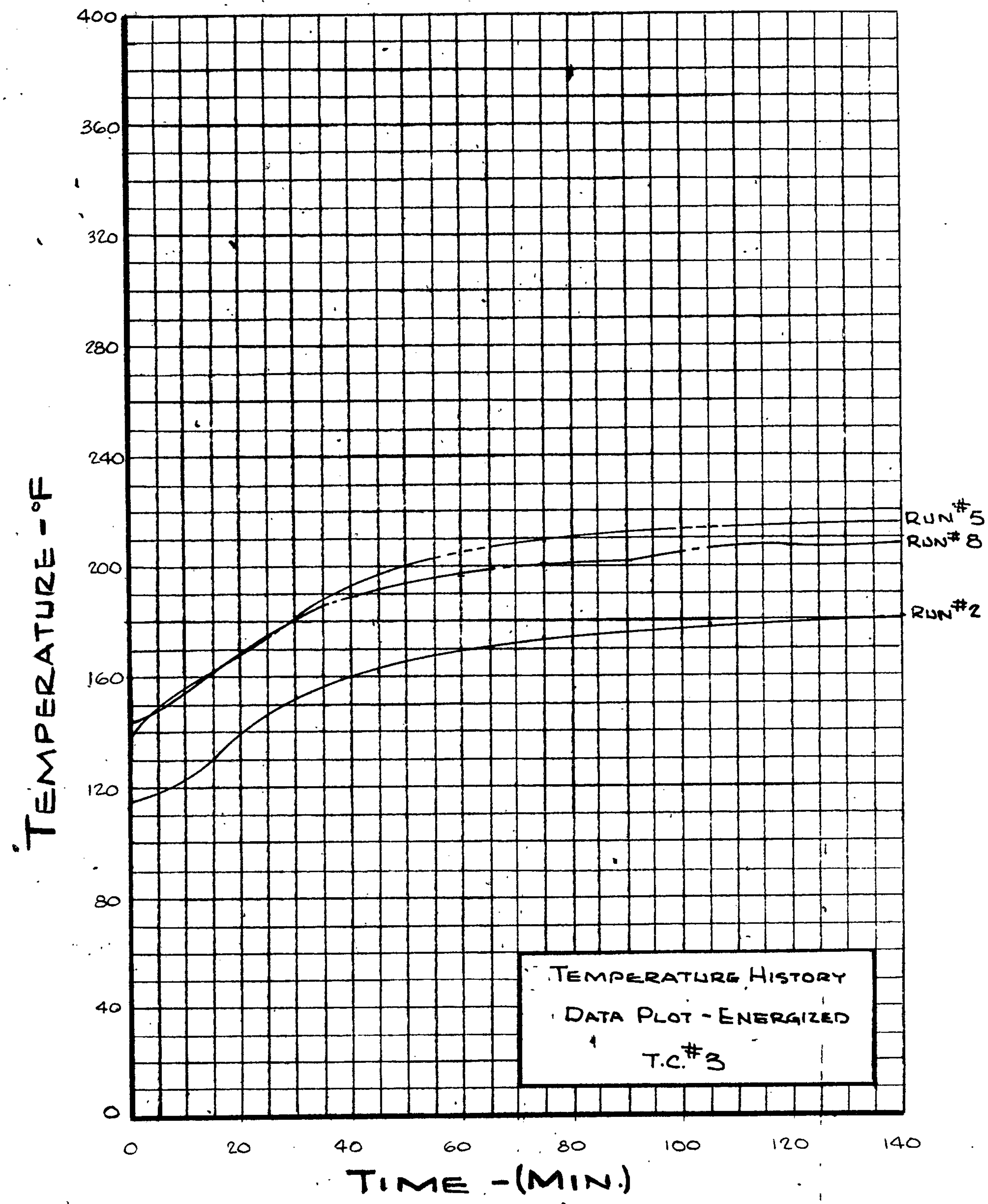


FIGURE Nº A3

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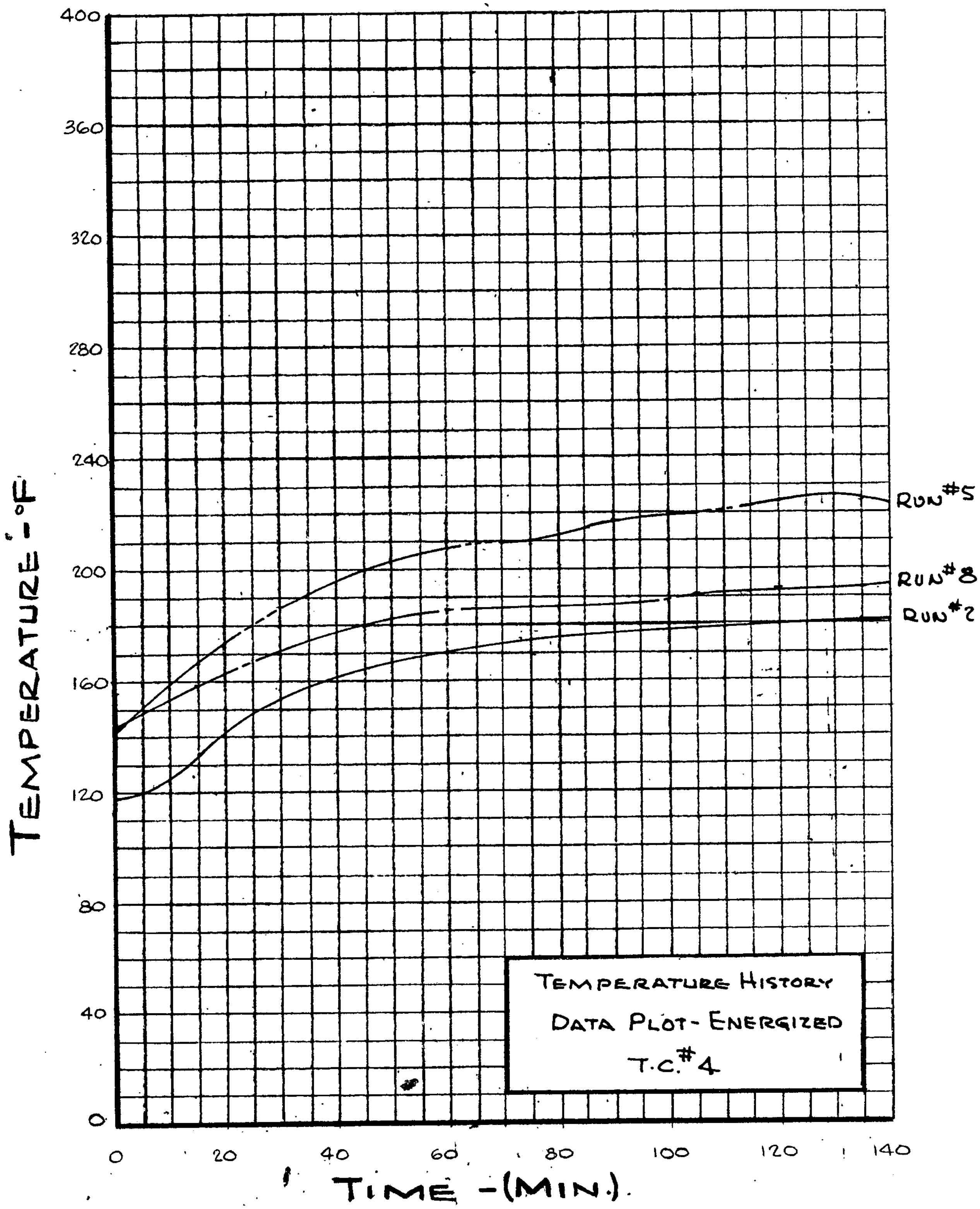


400
360
320
280
240
200
160
120
80
40
0
TEMPERATURE -°F
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN #5
RUN #8
RUN #2
TEMPERATURE HISTORY
DATA PLOT- ENERGIZED
T.C. #4

FIGURE Nº A4

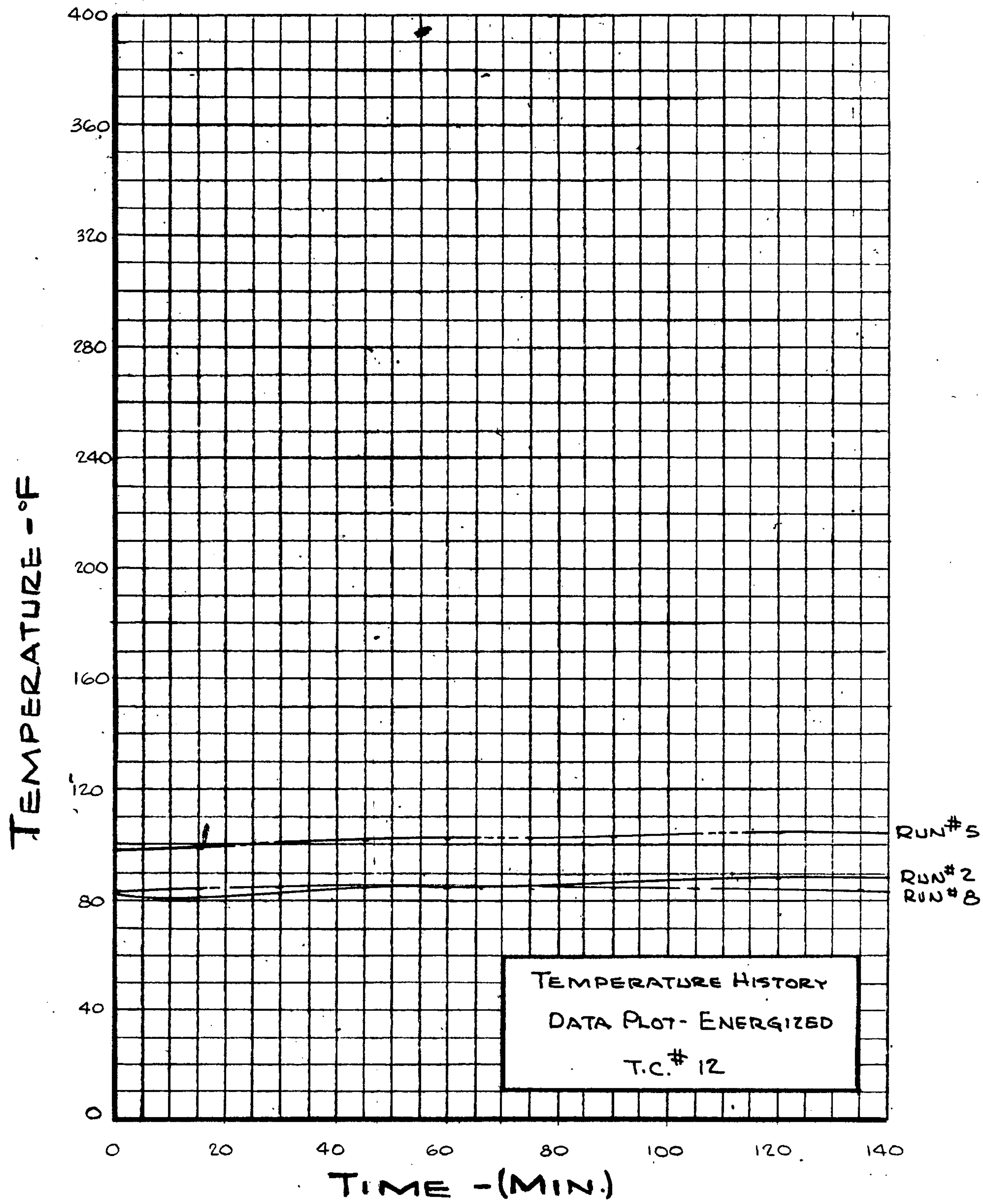

TEMPERATURE - °F
400
360
320
280
240
200
160
120
80
40
0
RUN # 5
RUN # 2
RUN # 8
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C. # 12
0
20
40
60
80
100
120
140
TIME -(MIN.)

FIGURE Nº A5

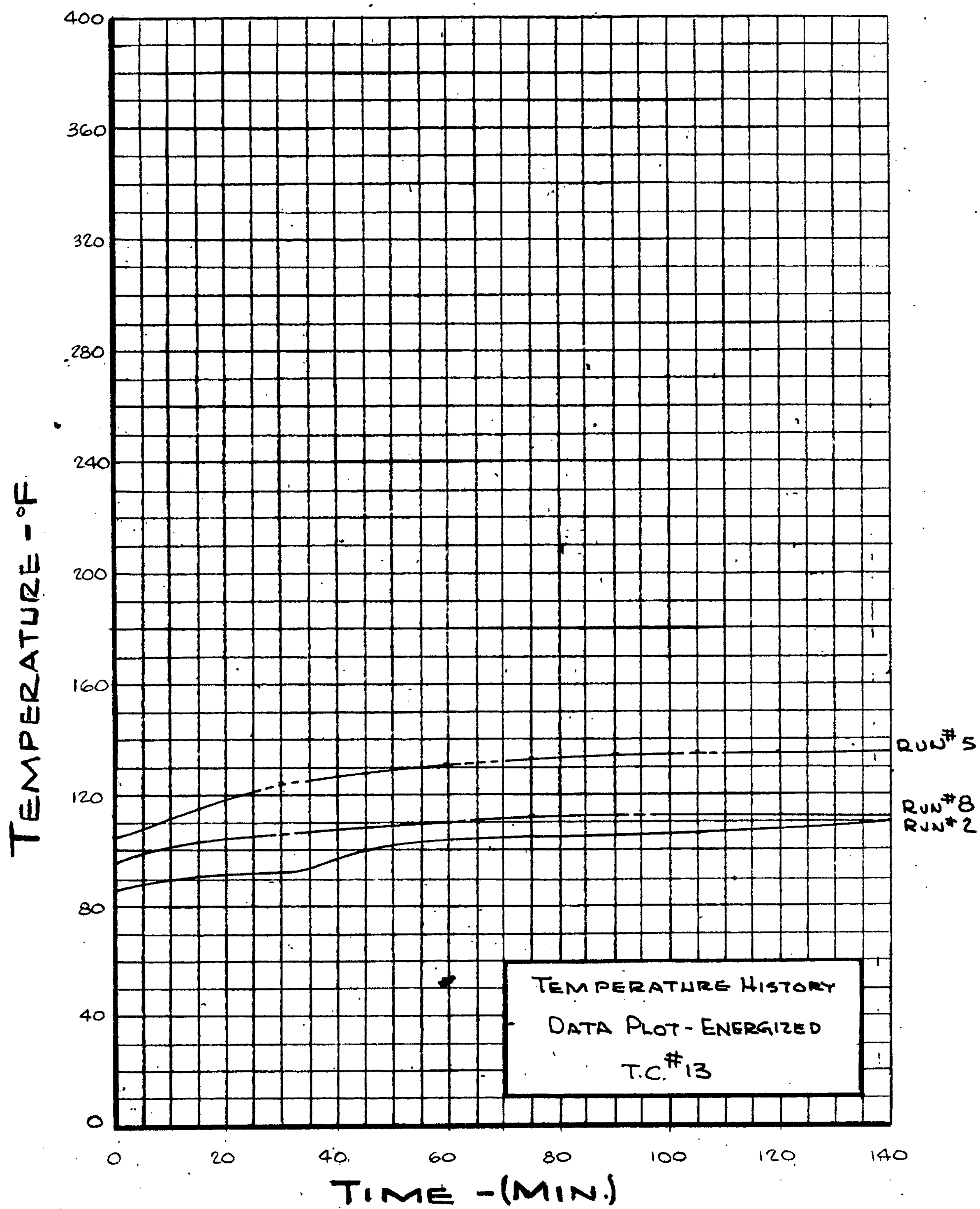
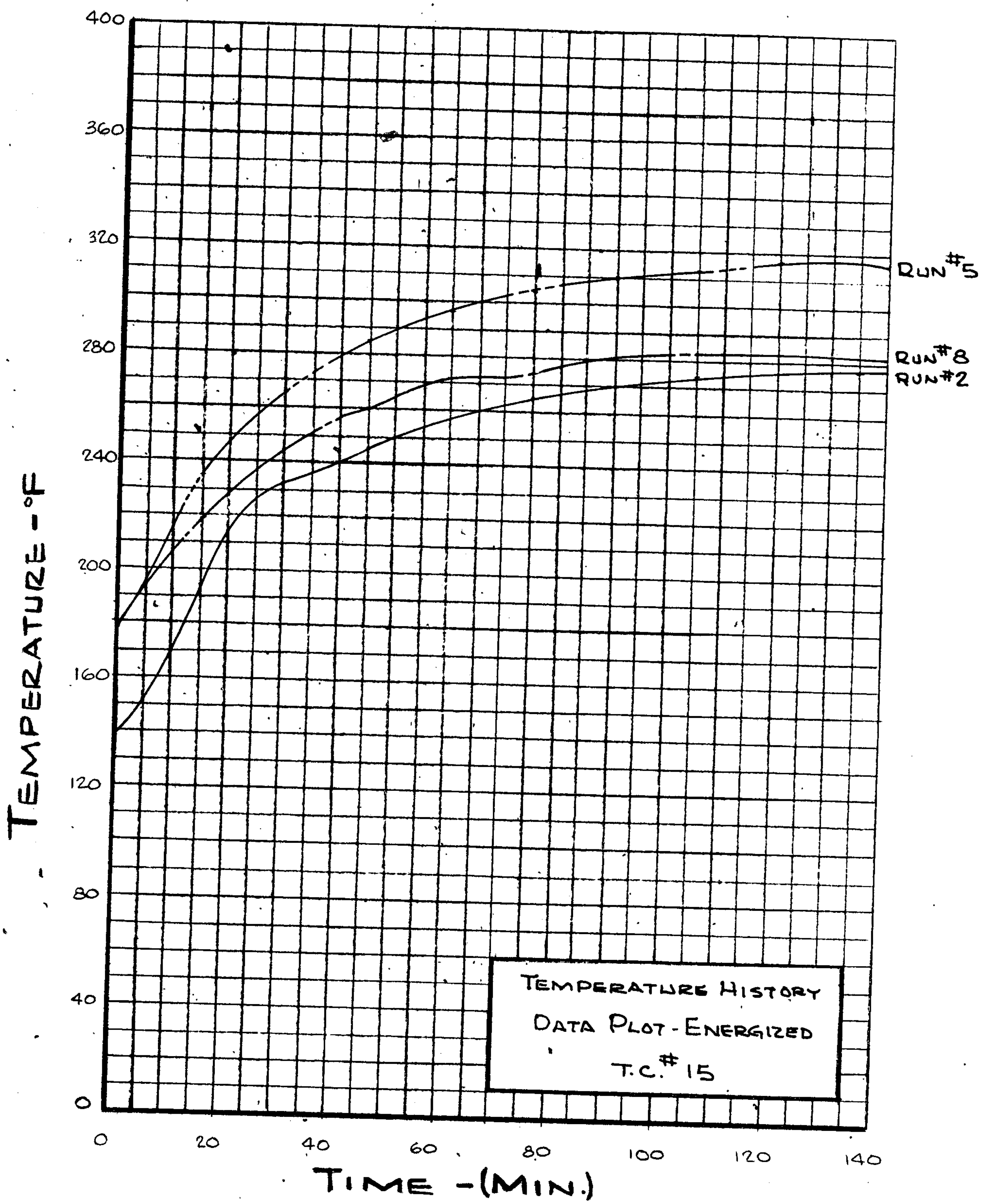
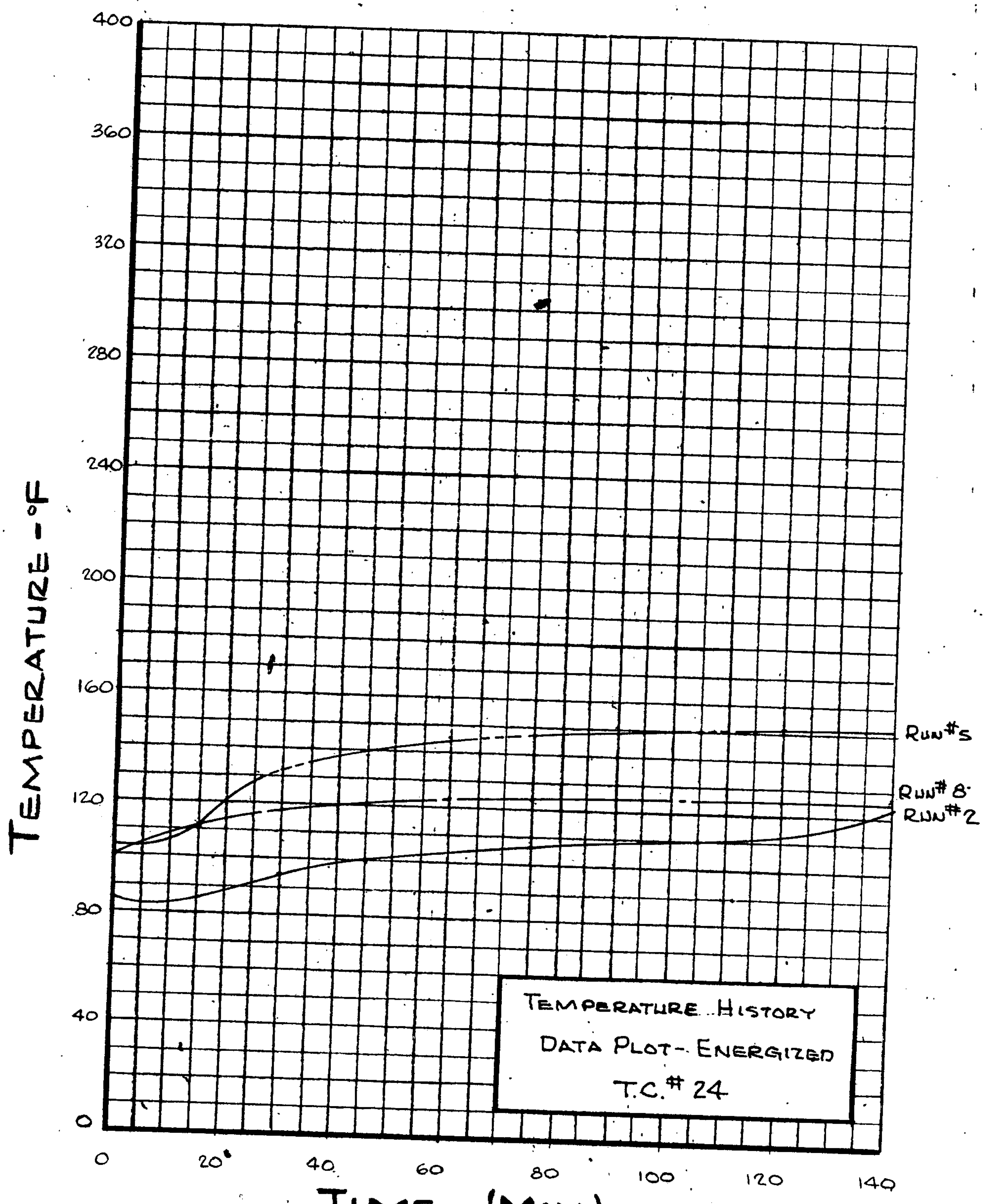

400
360
320
280
240
200
160
120
80
40
0
TEMPERATURE - °F
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN # 5
RUN # 8
RUN # 2
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C. # 13

FIGURE Nº A6



TEMPERATURE - °F
400
360
320
280
240
200
160
120
80
40
0
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN #5
RUN #8
RUN #2
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C. # 15

FIGURE Nº A7



400
360
320
280
240
200
160
120
80
40
0
TEMPERATURE - °F
0
20
40
60
80
100
120
140
TIME -(MIN.)
RUN #5
RUN # 8
RUN # 2
TEMPERATURE HISTORY
DATA PLOT - ENERGIZED
T.C. # 24

FIGURE Nº A8

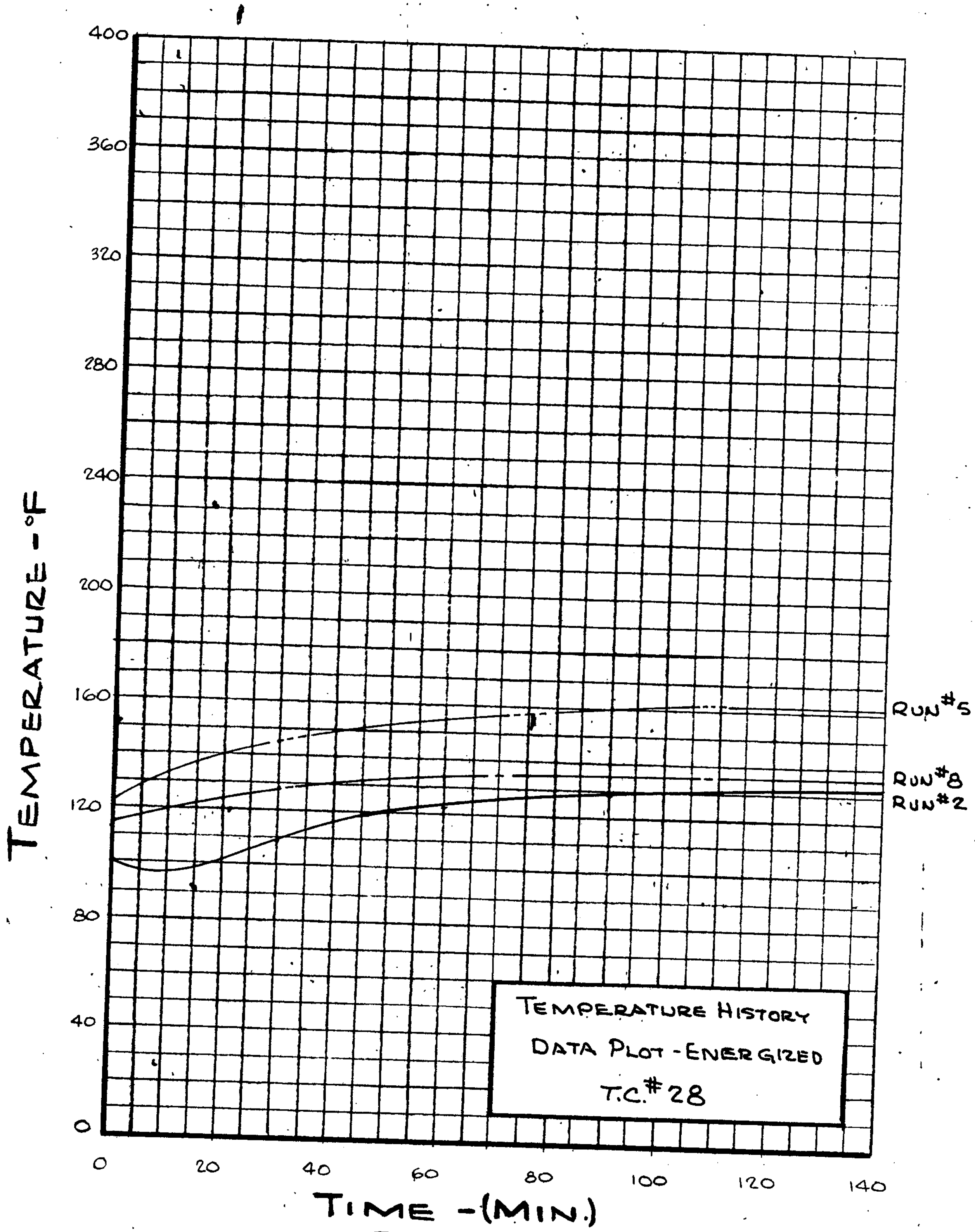


FIGURE Nº A9

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

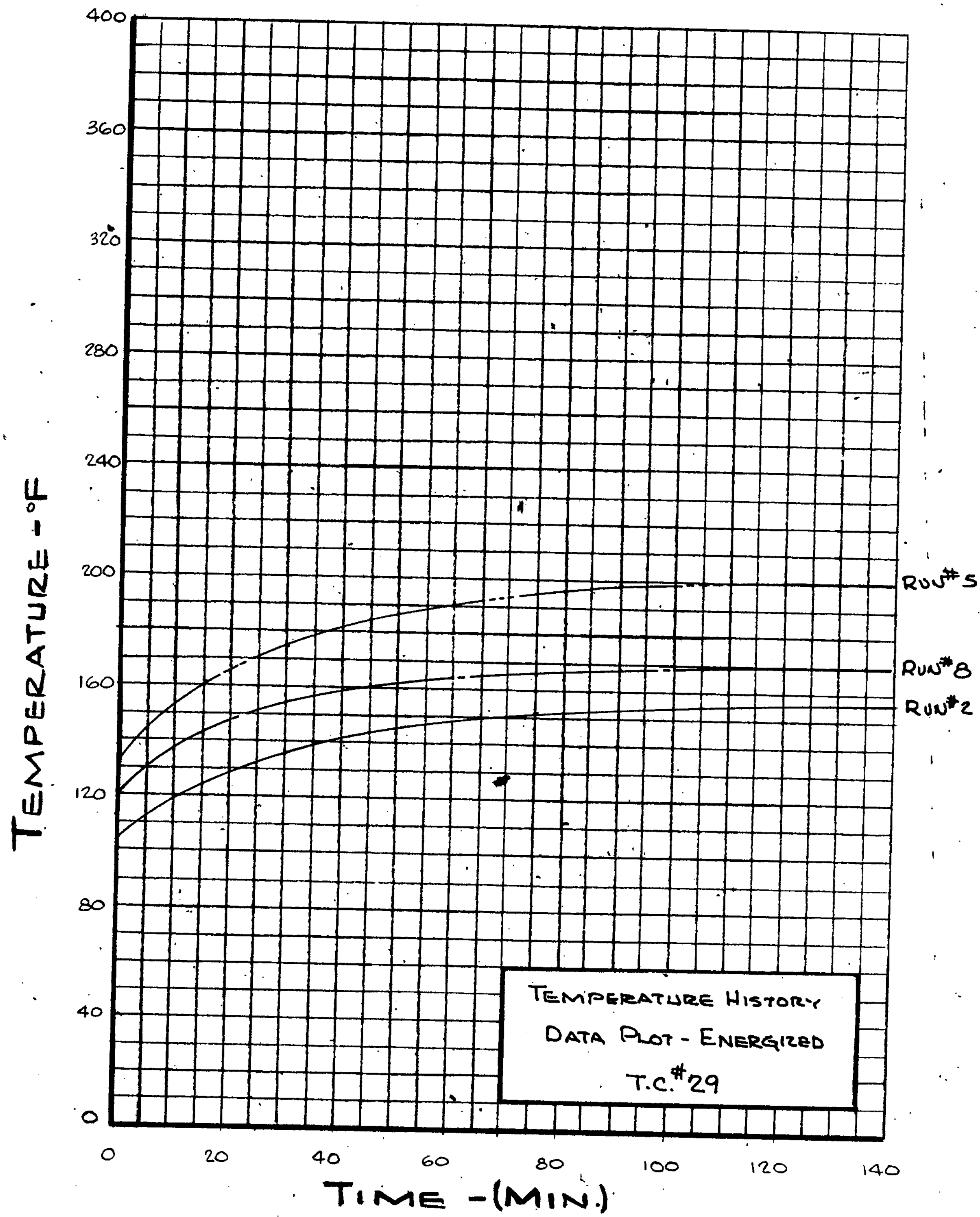


FIGURE Nº A10

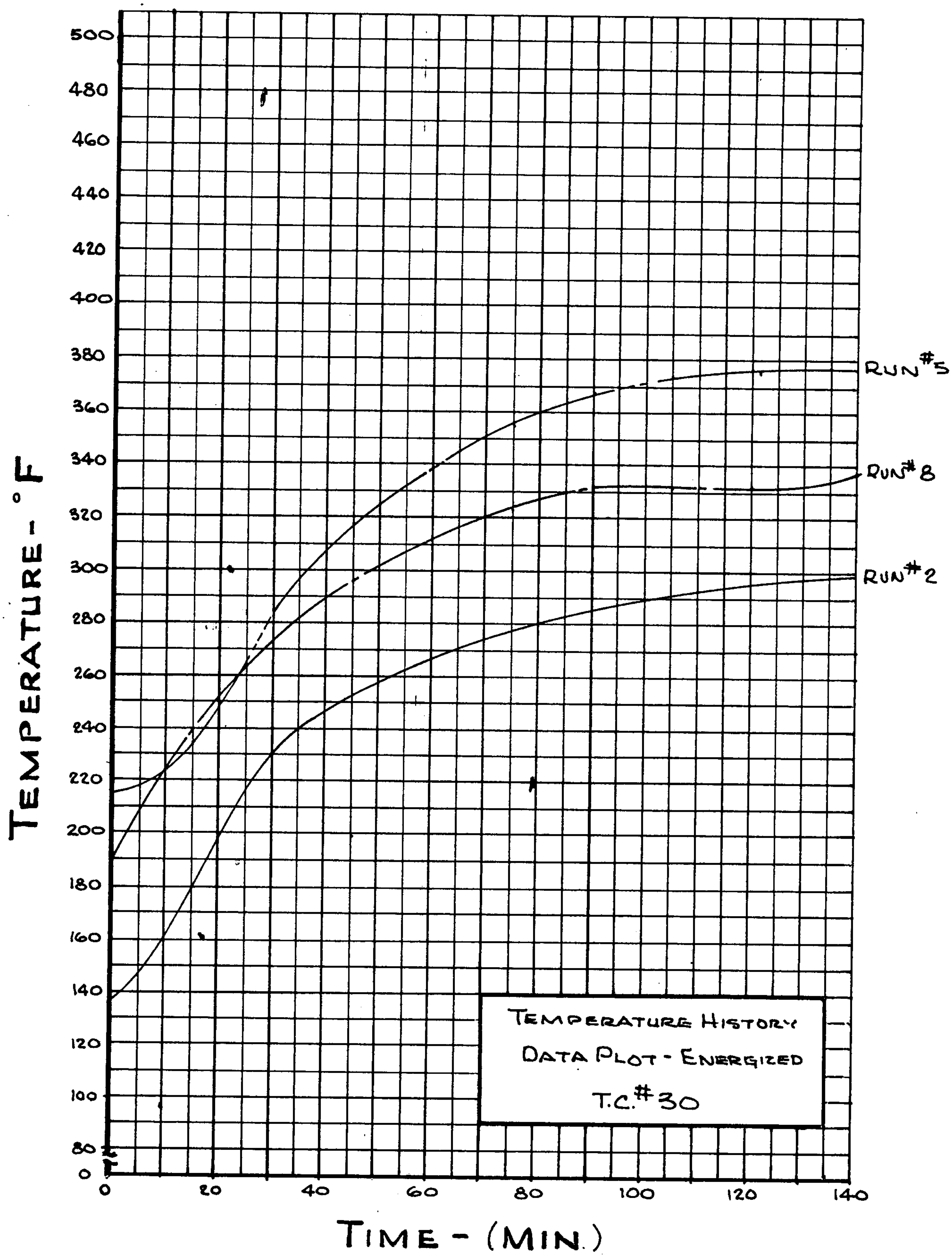


FIGURE Nº A11

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

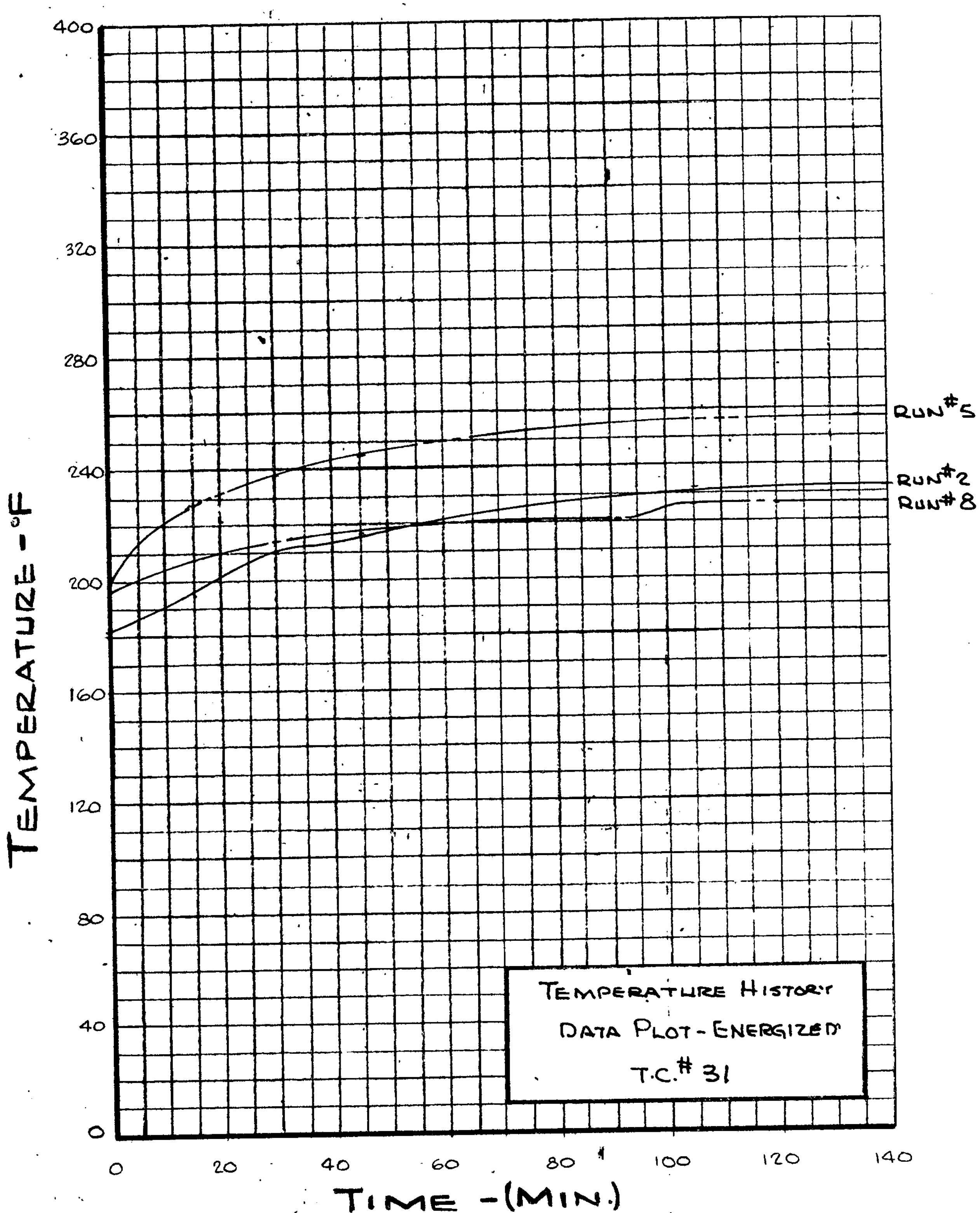


FIGURE Nº A12

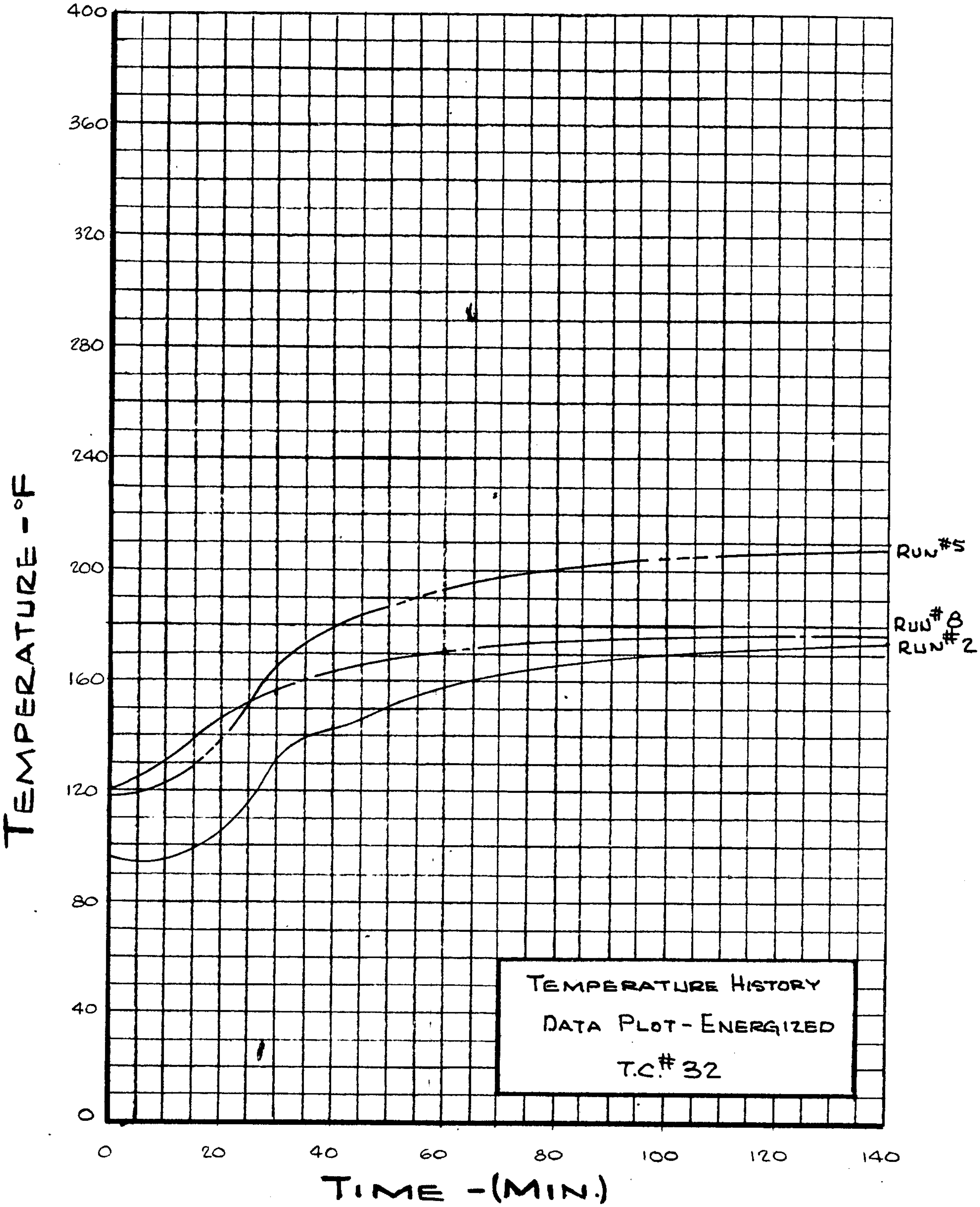


FIGURE Nº A13

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

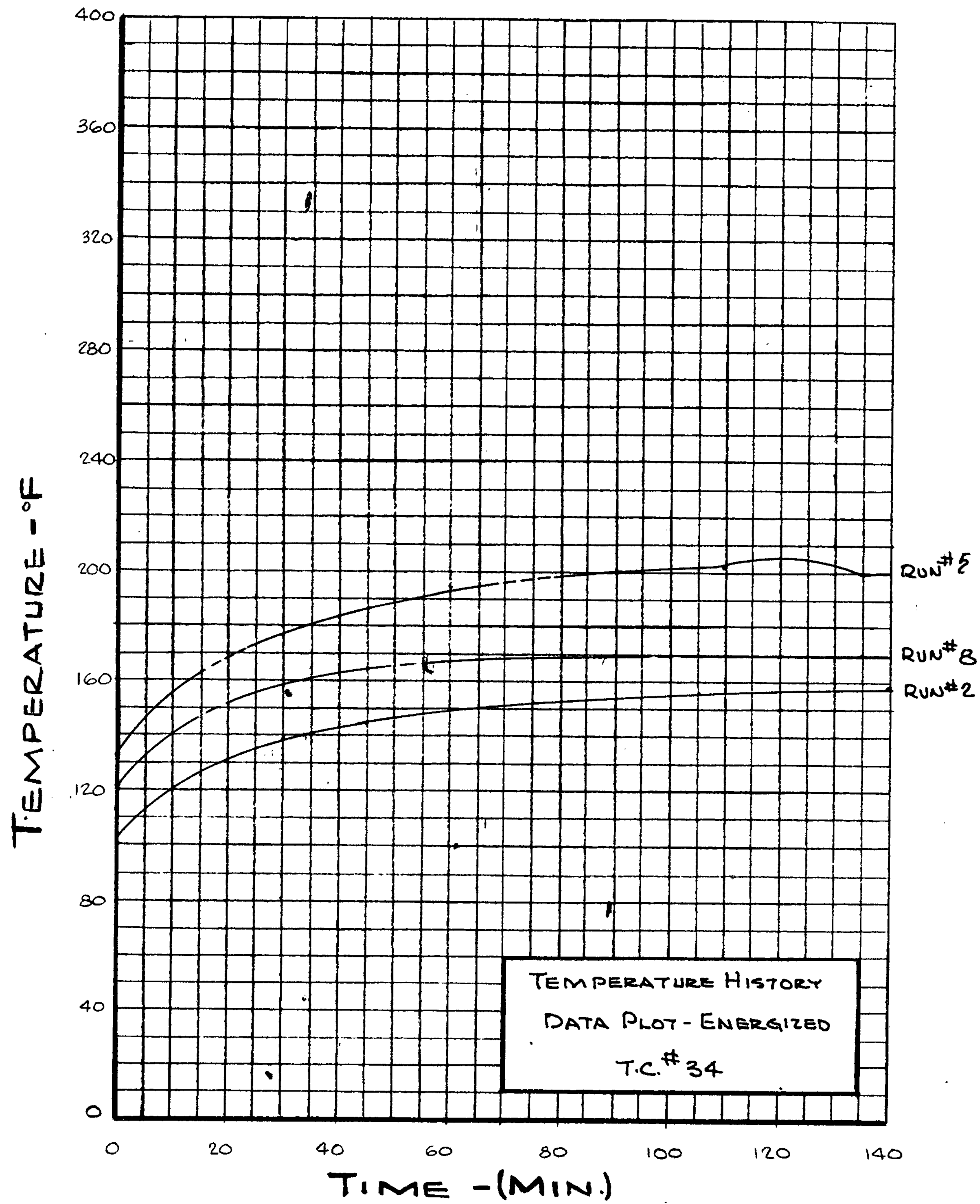


FIGURE Nº A14

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

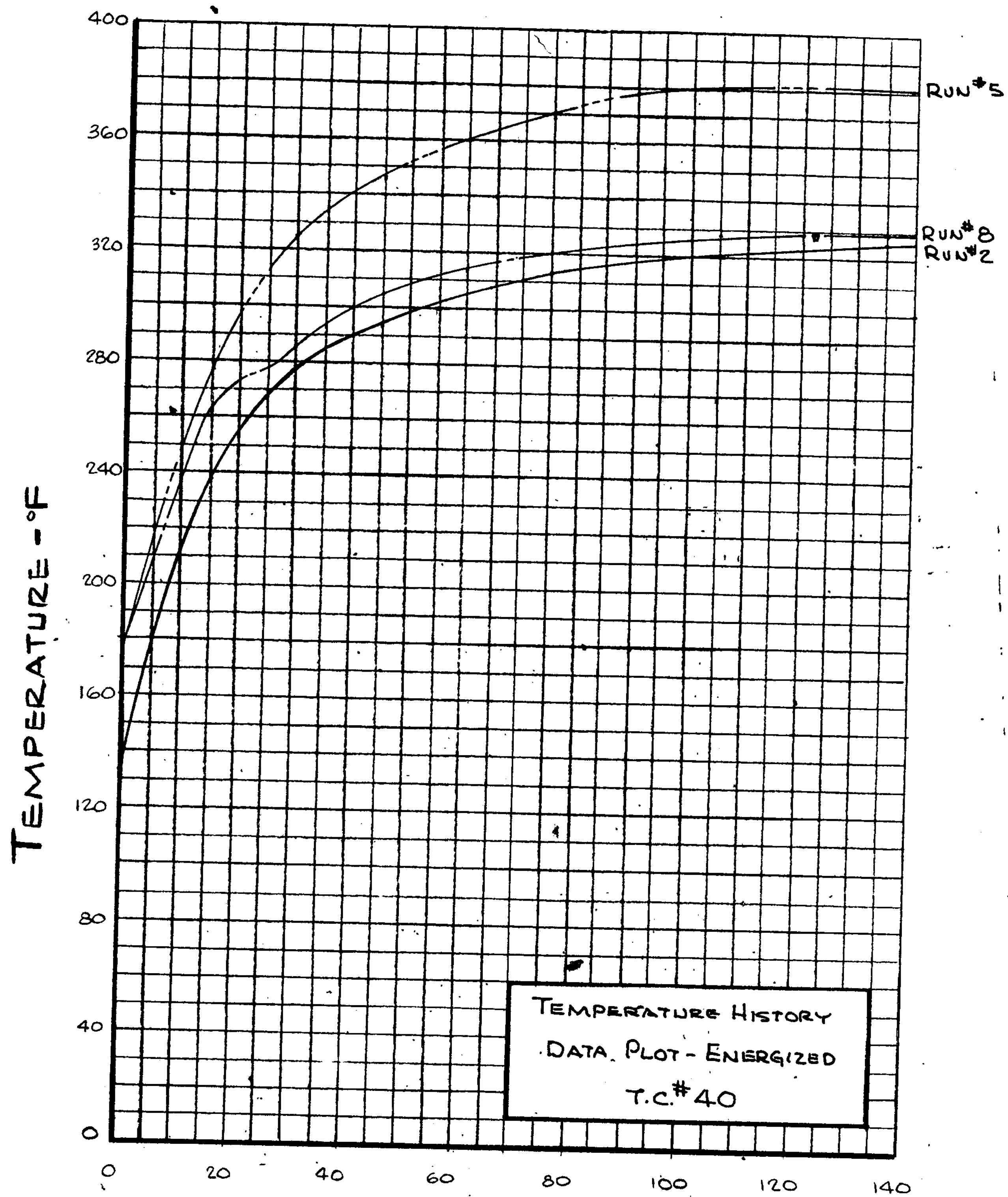


FIGURE Nº A15

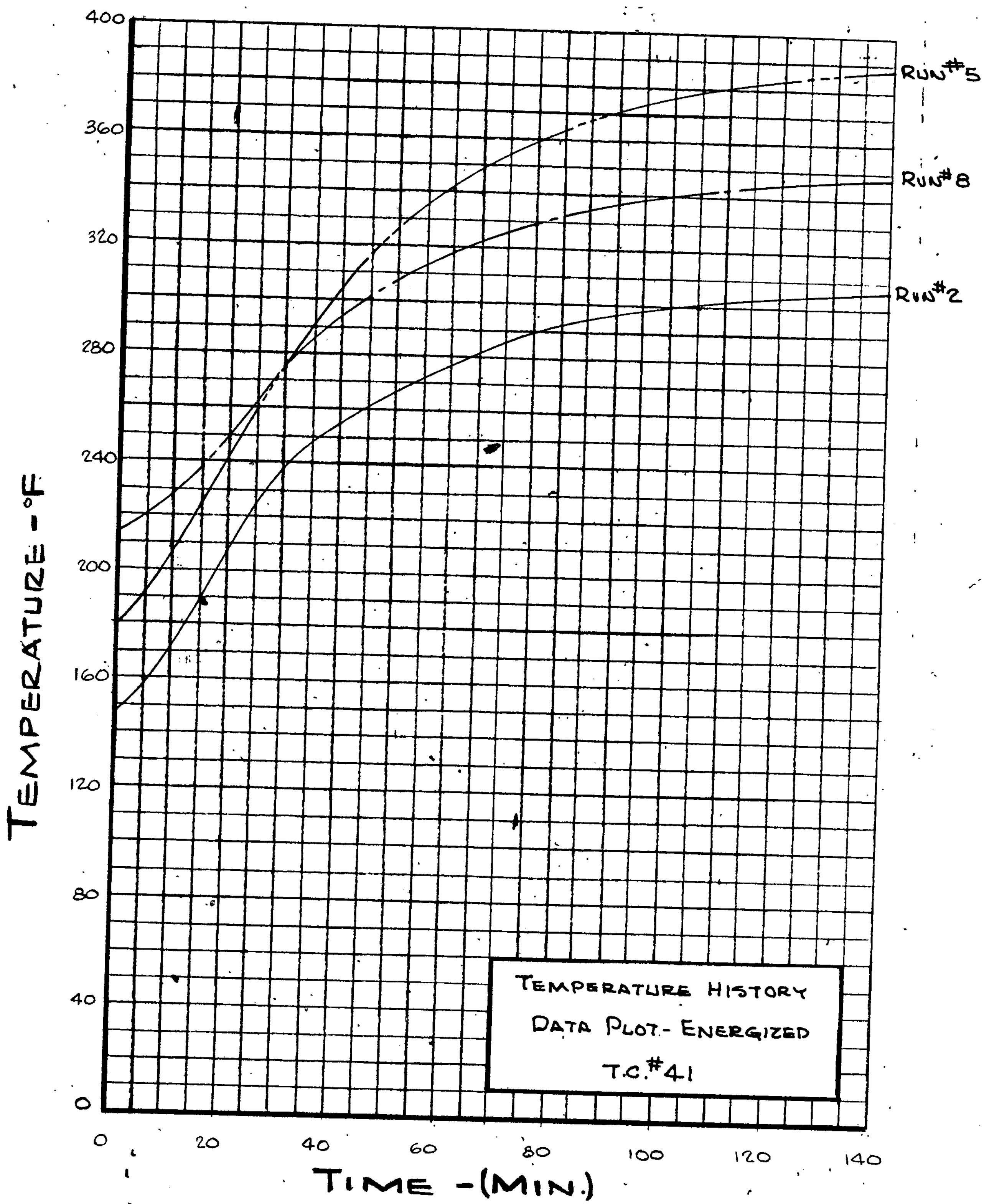


FIGURE Nº A16

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

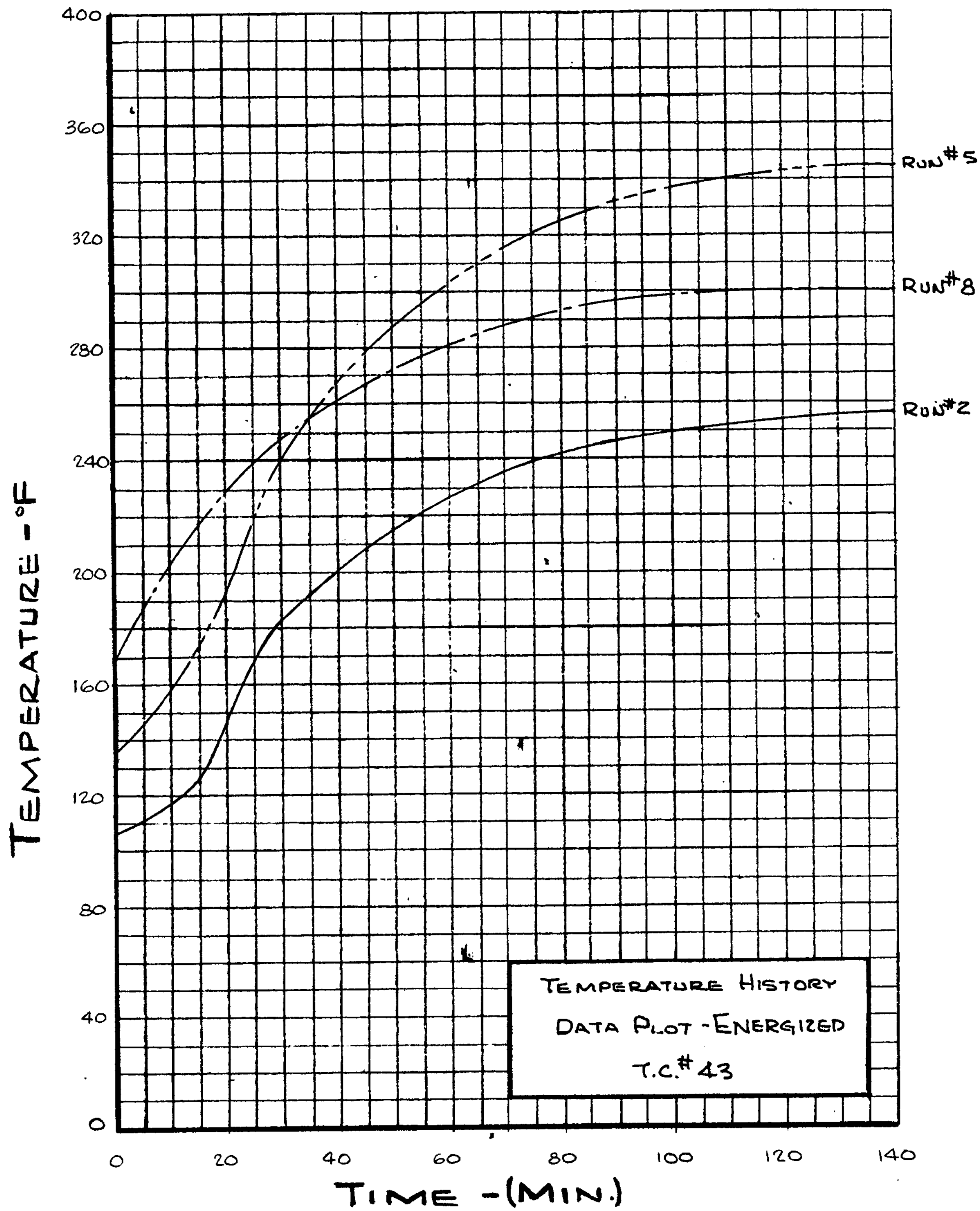


FIGURE Nº A17

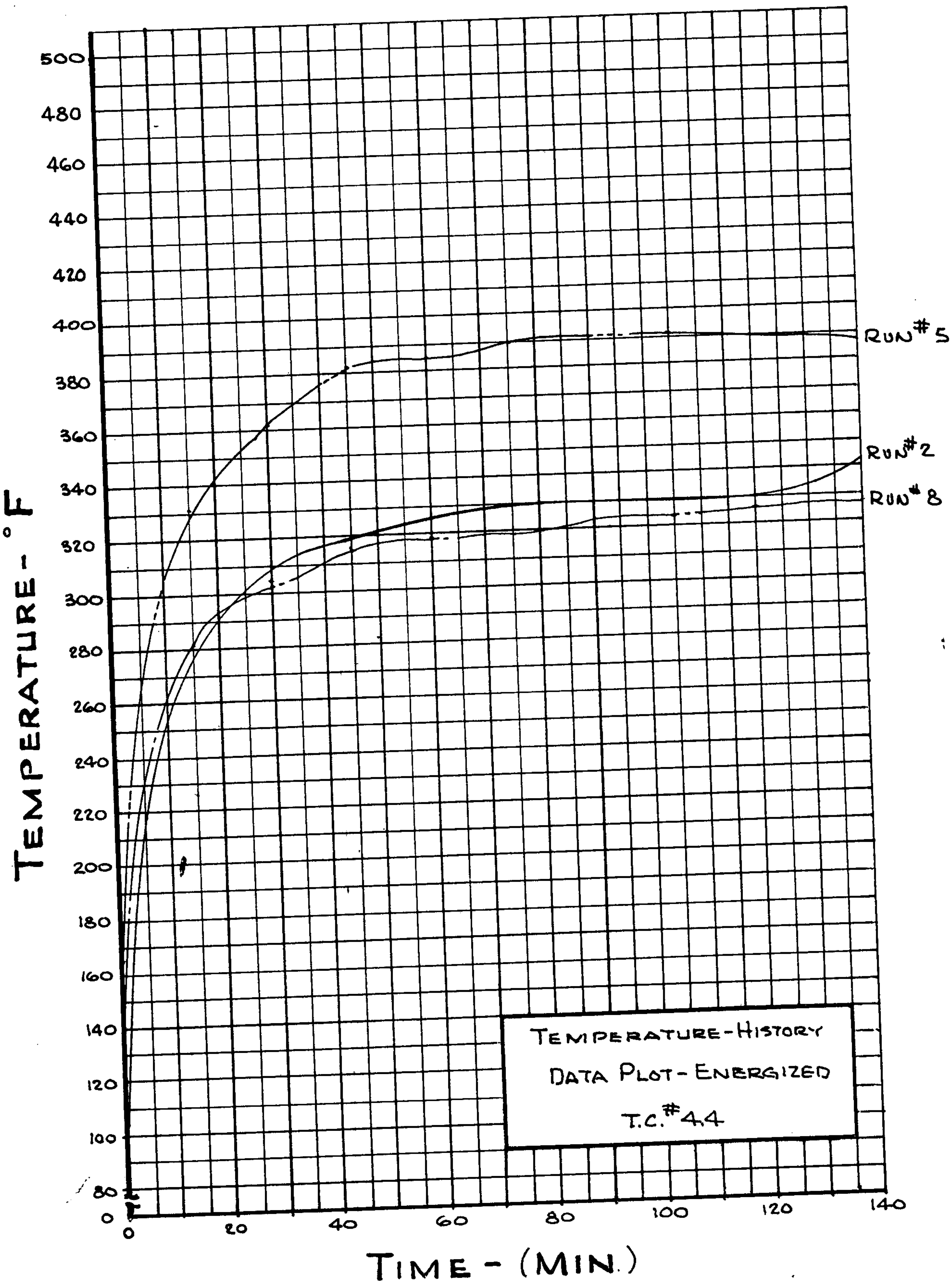


FIGURE Nº A18

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

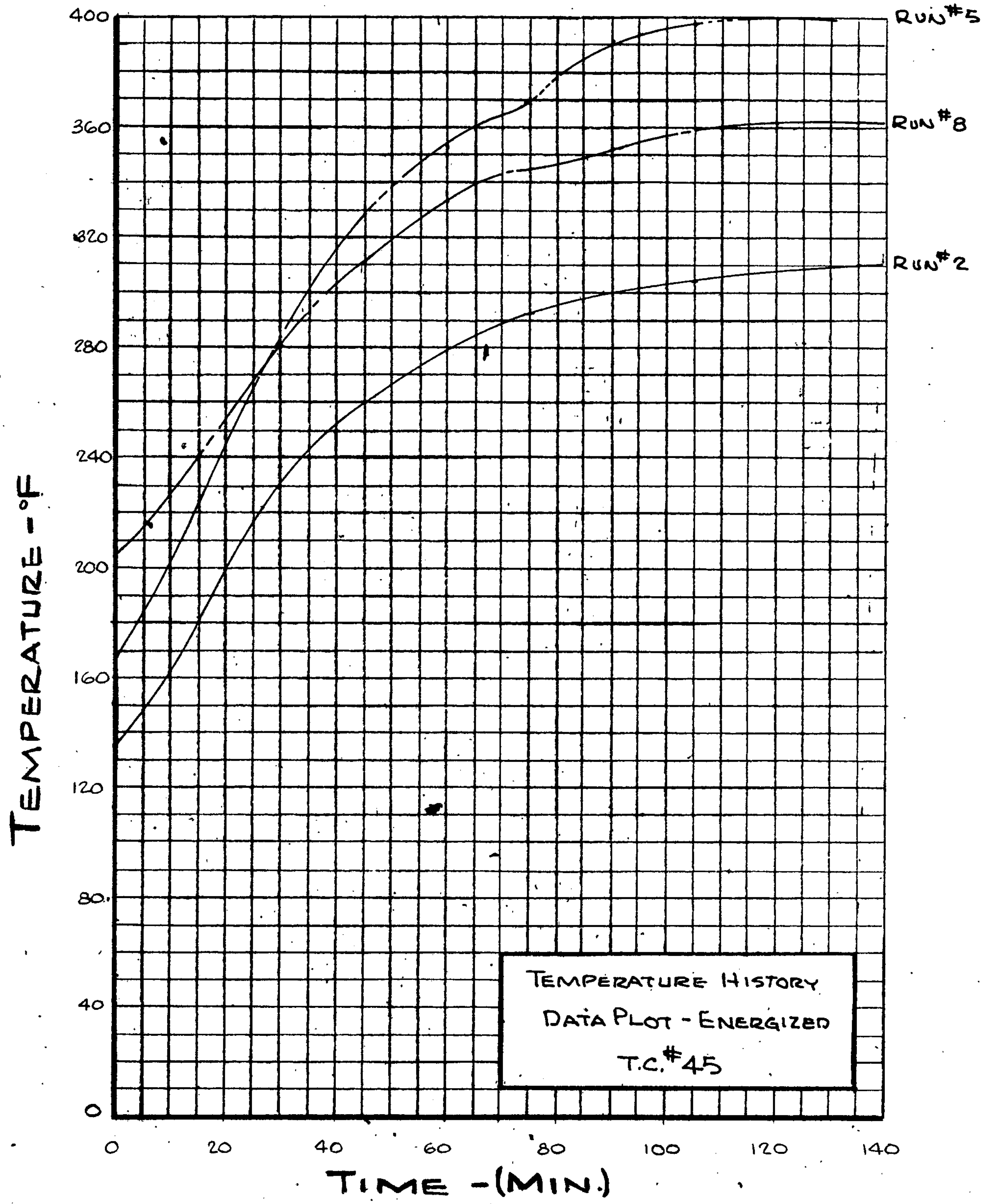


FIGURE Nº A19

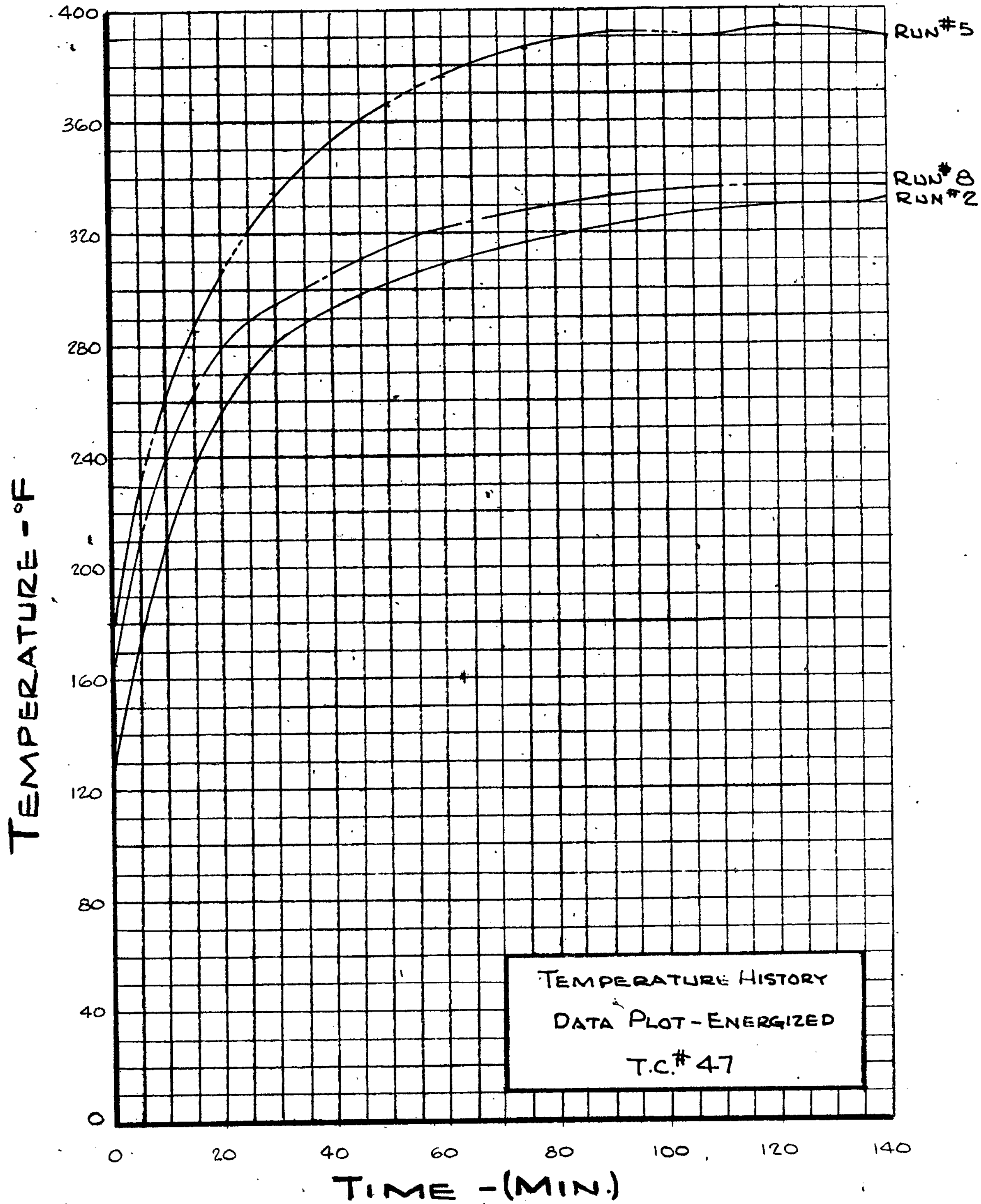


FIGURE Nº A20

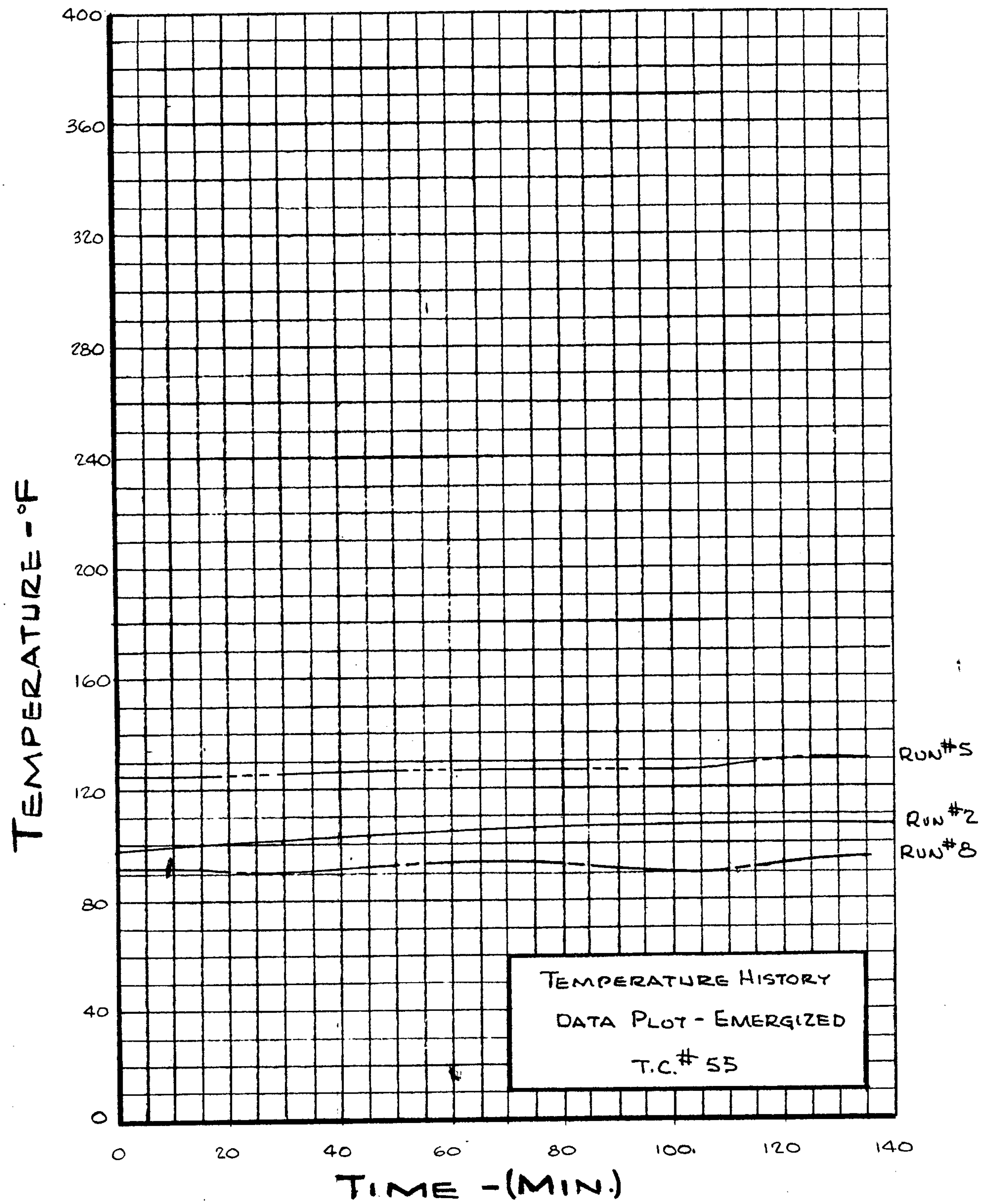


FIGURE Nº A21

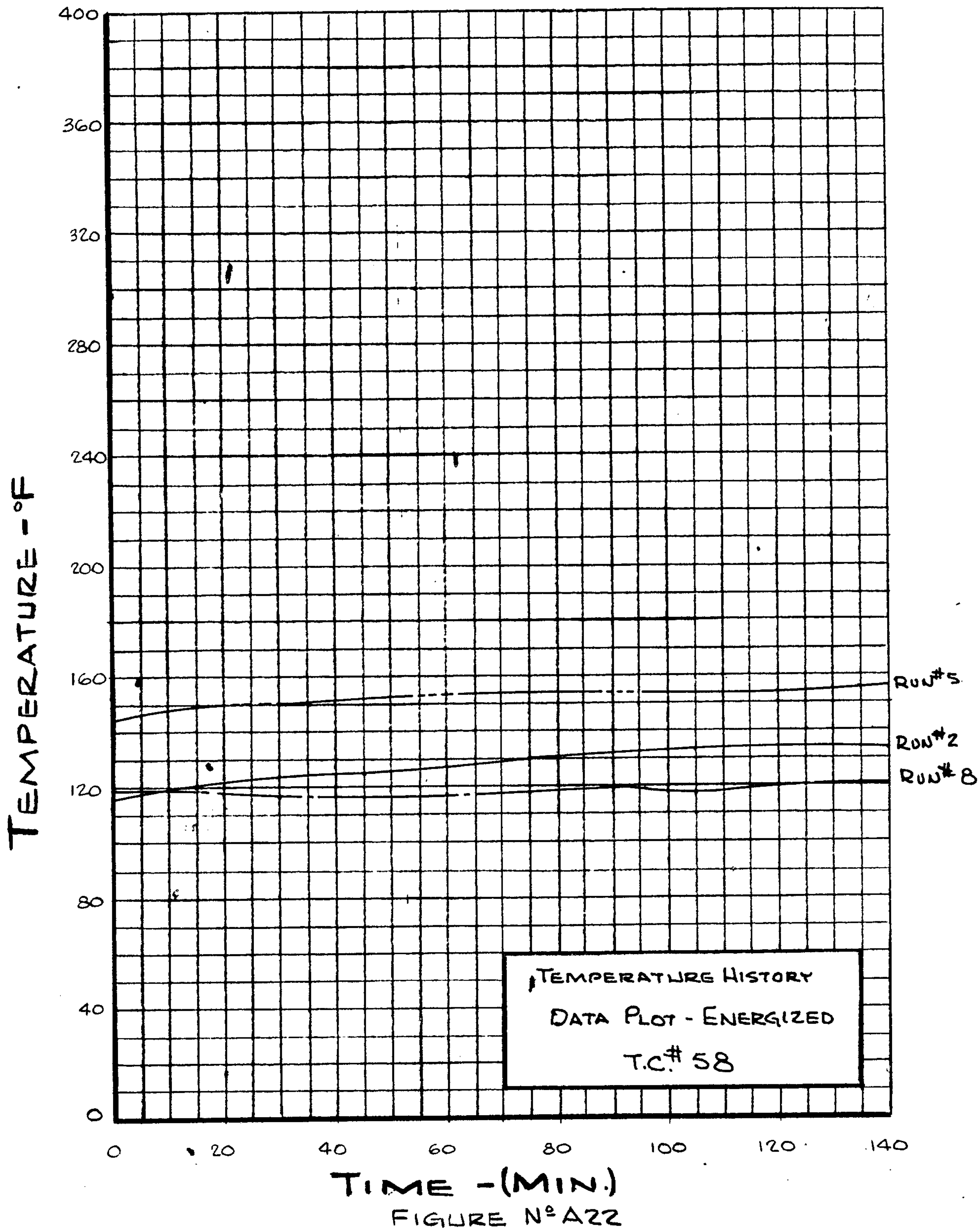


FIGURE Nº A22

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

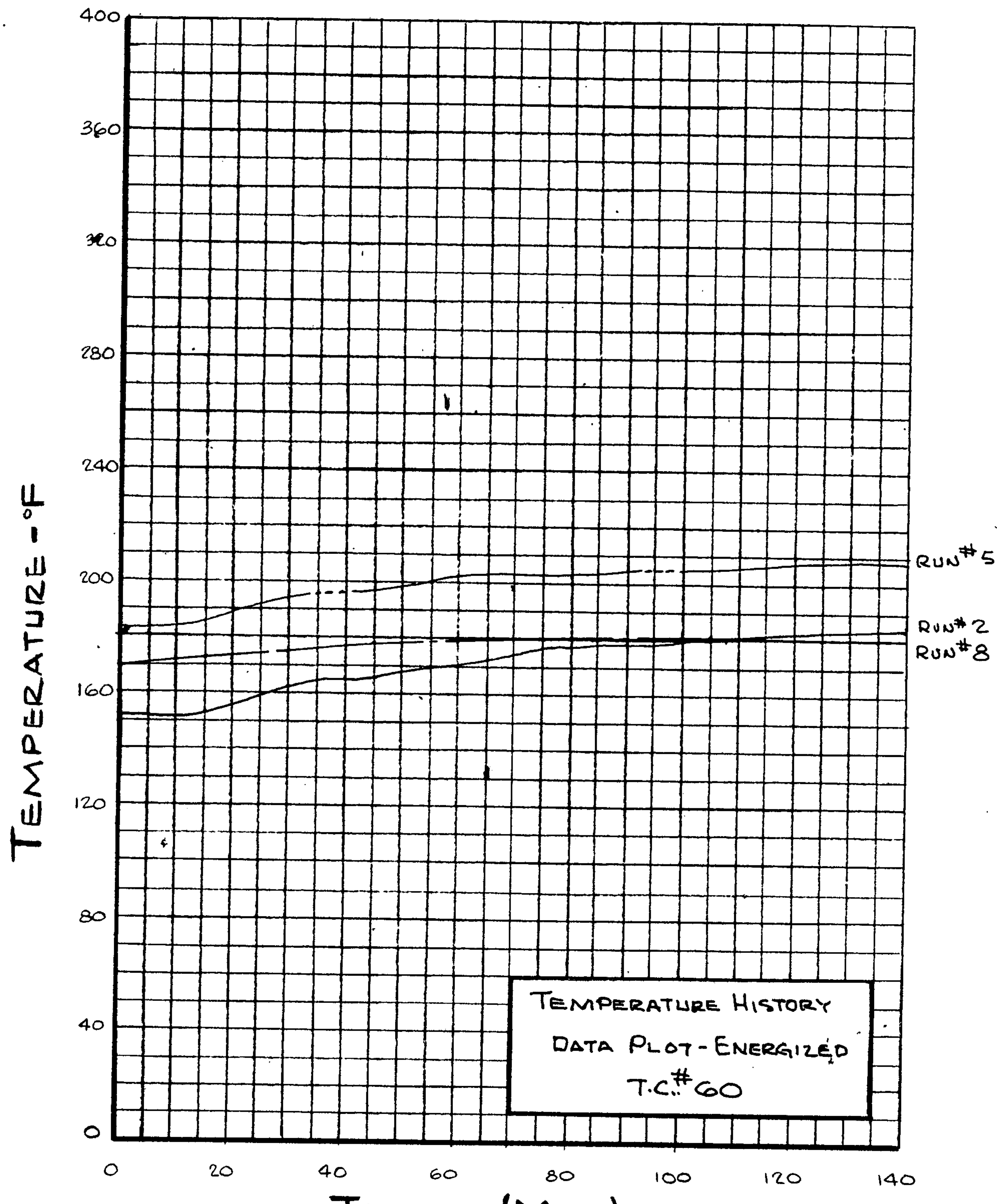


FIGURE Nº A23

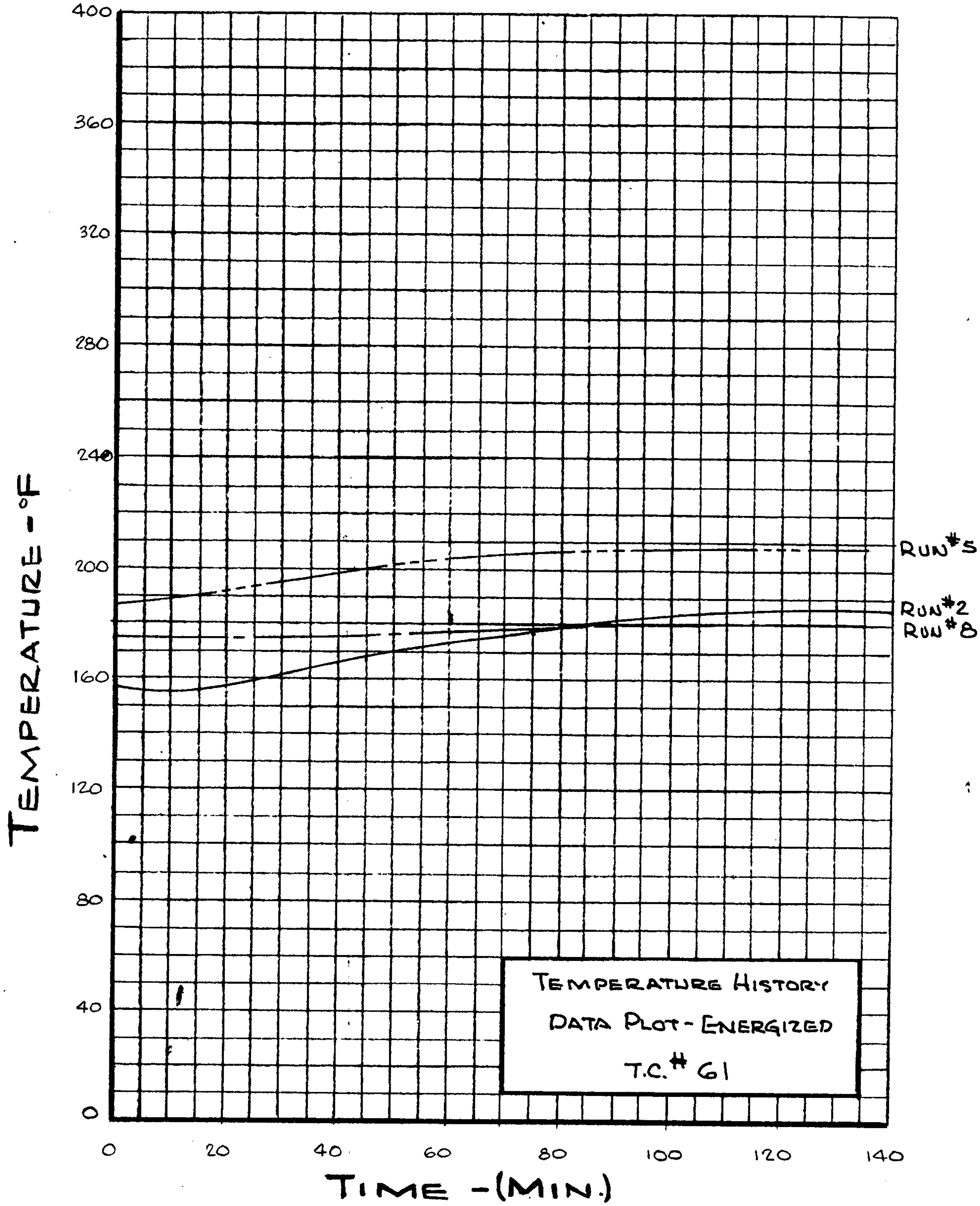


FIGURE Nº A24

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

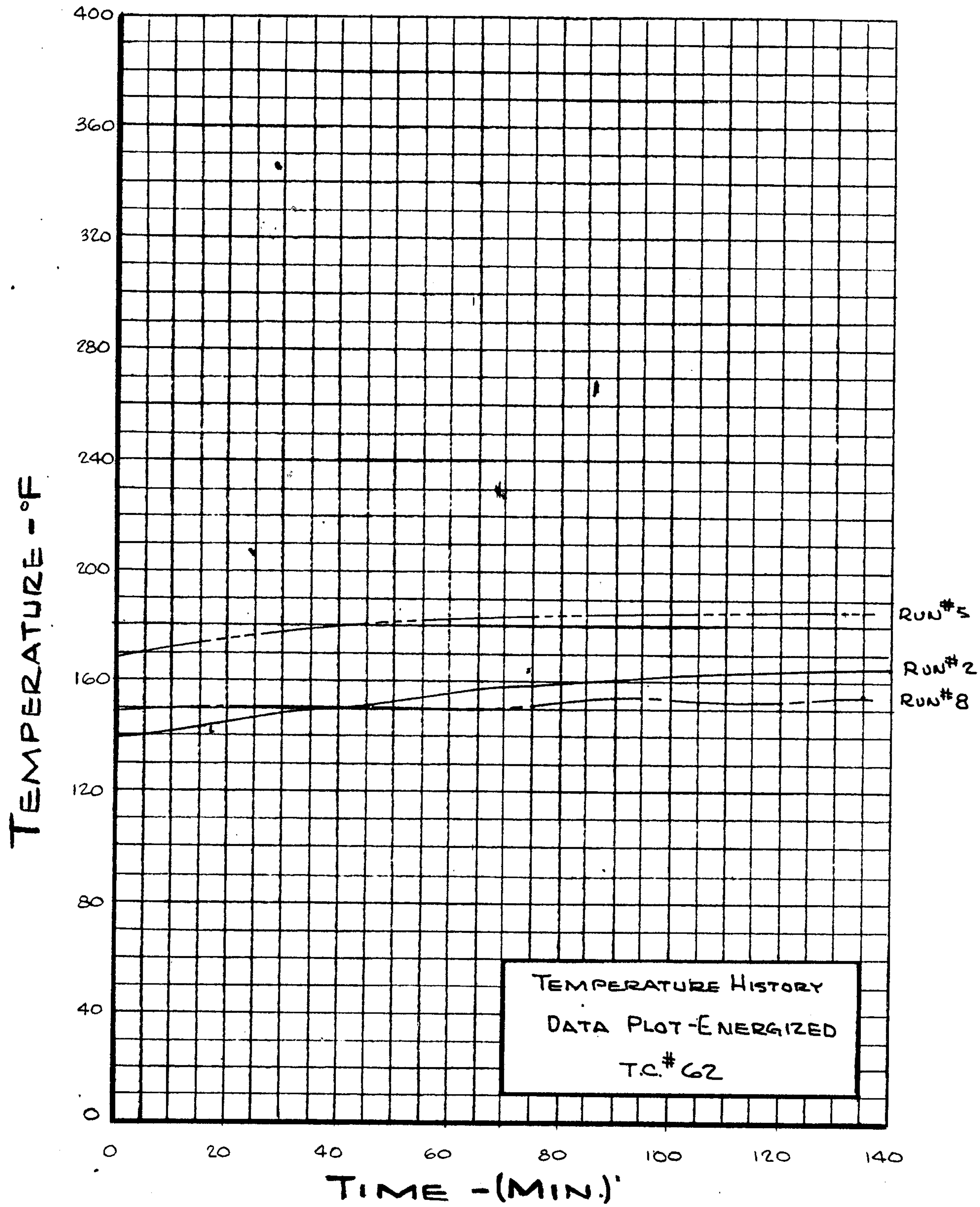


FIGURE Nº A25

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

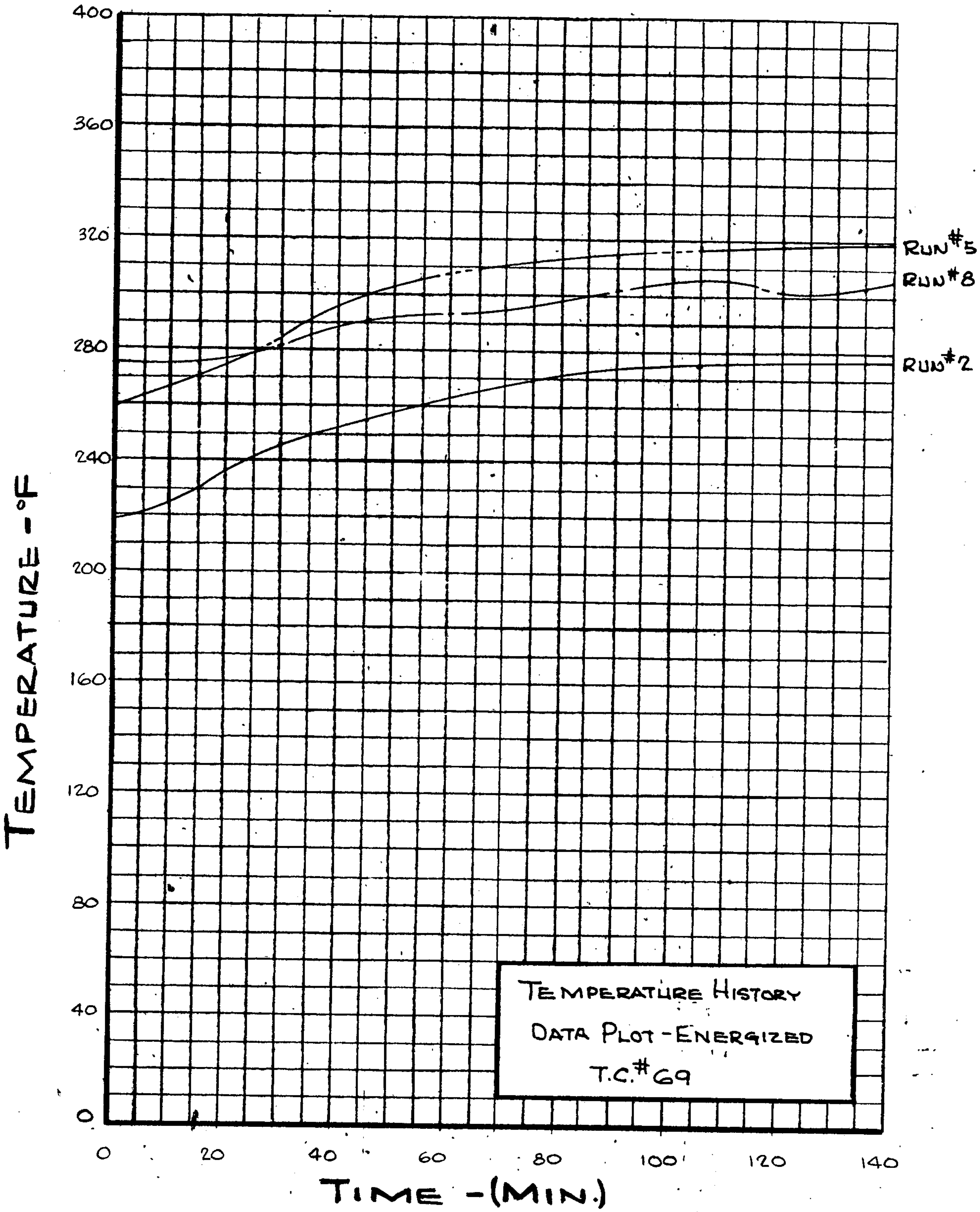


FIGURE Nº A26

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

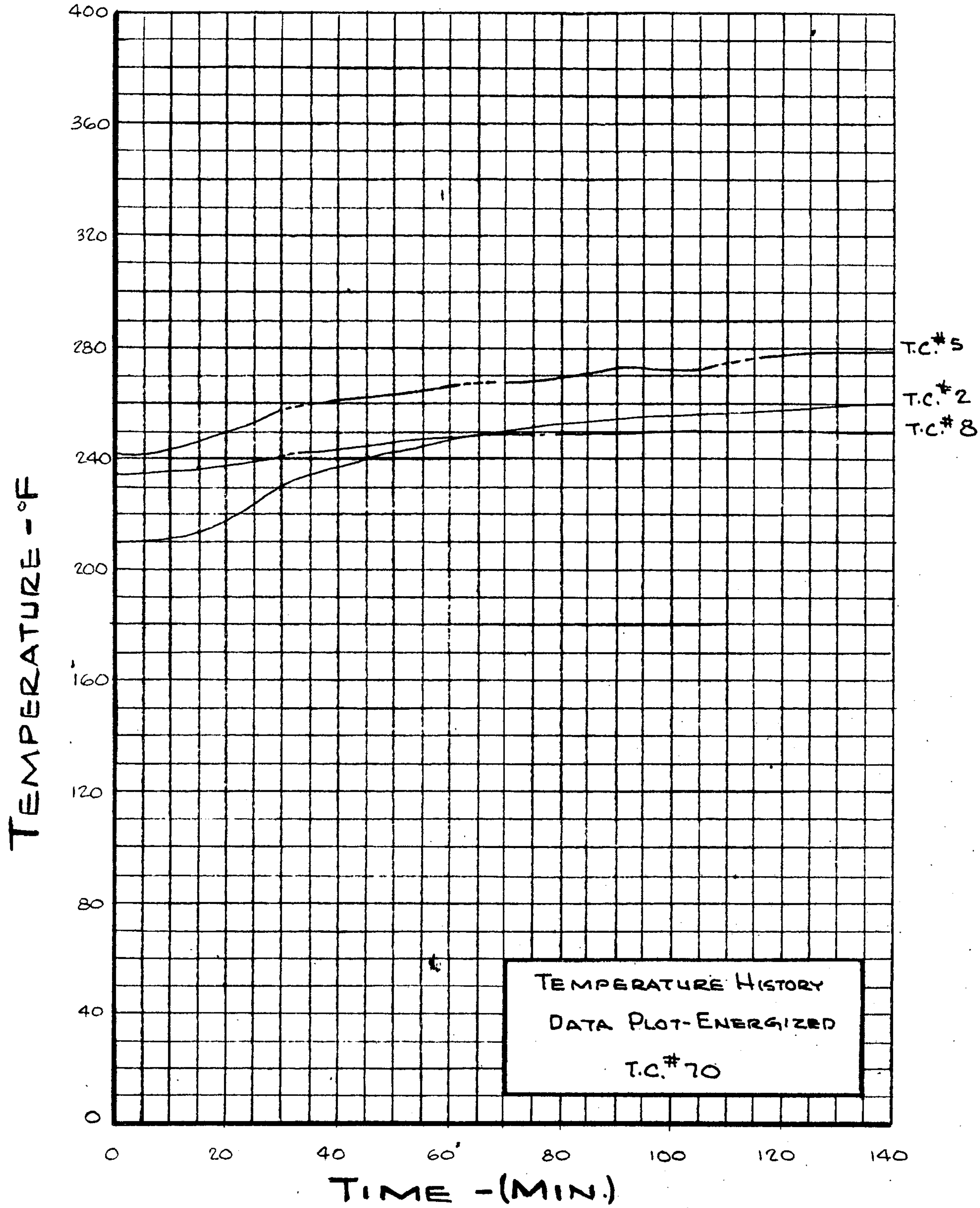


FIGURE Nº A27

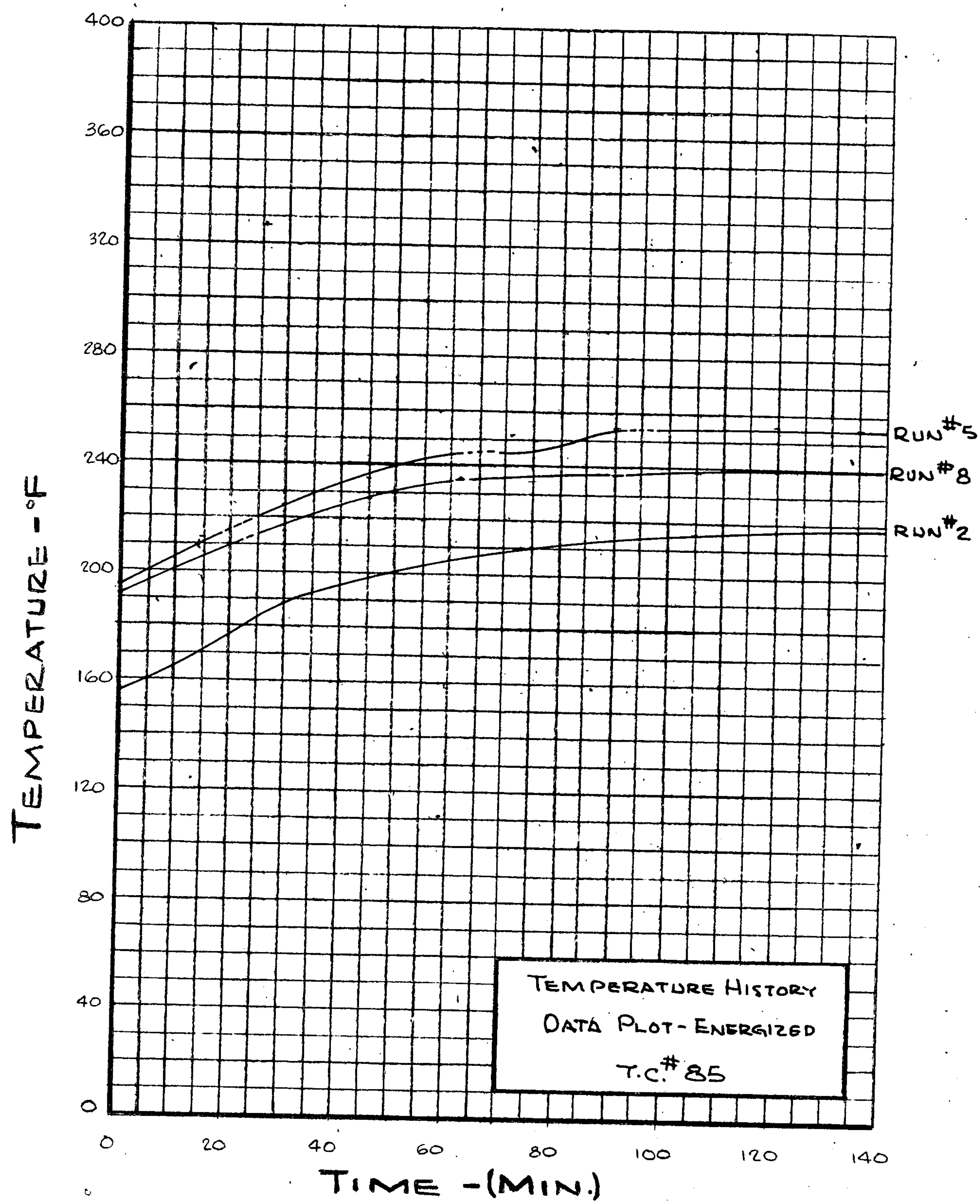


FIGURE Nº A28

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

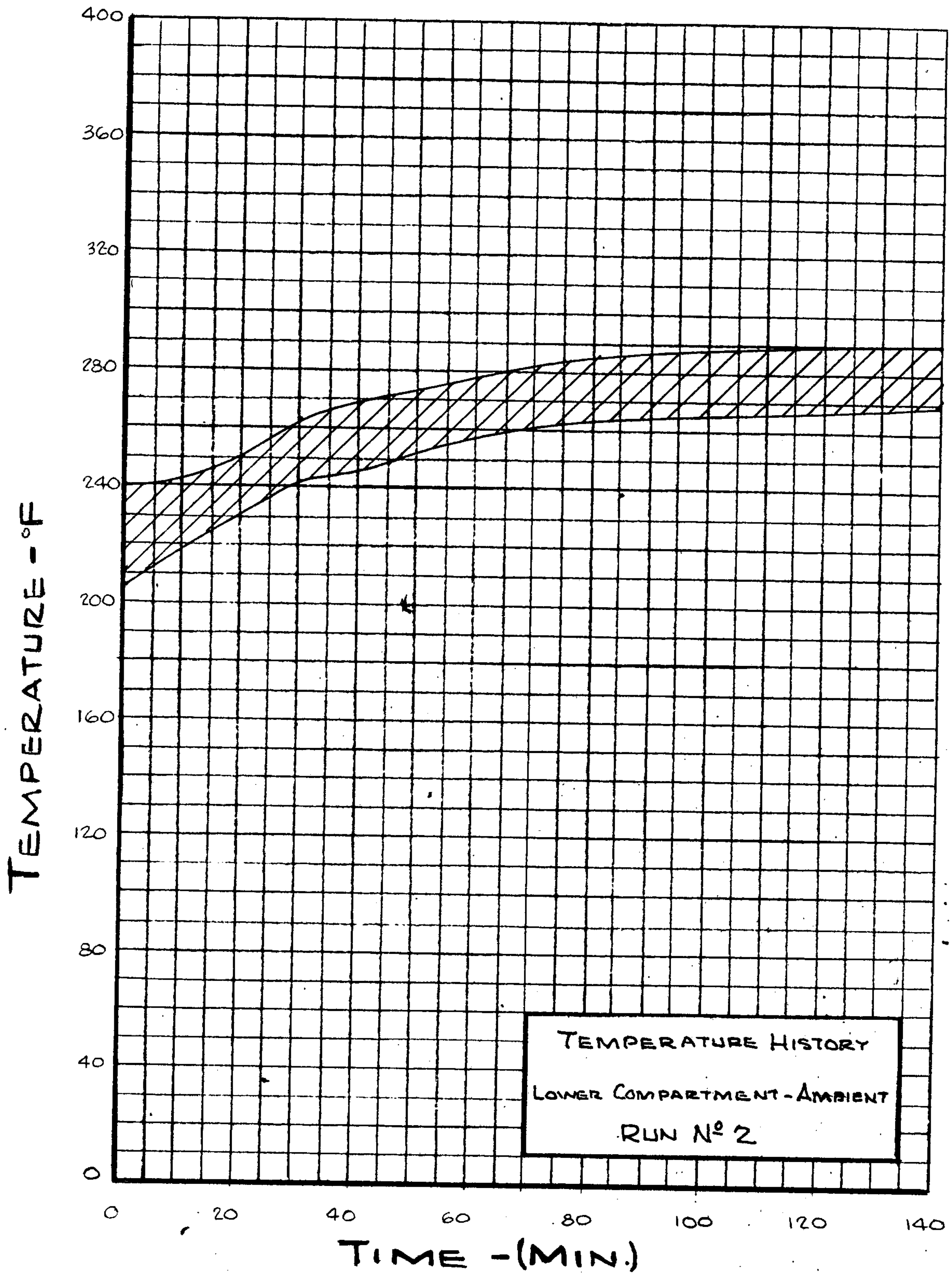


FIGURE Nº A29

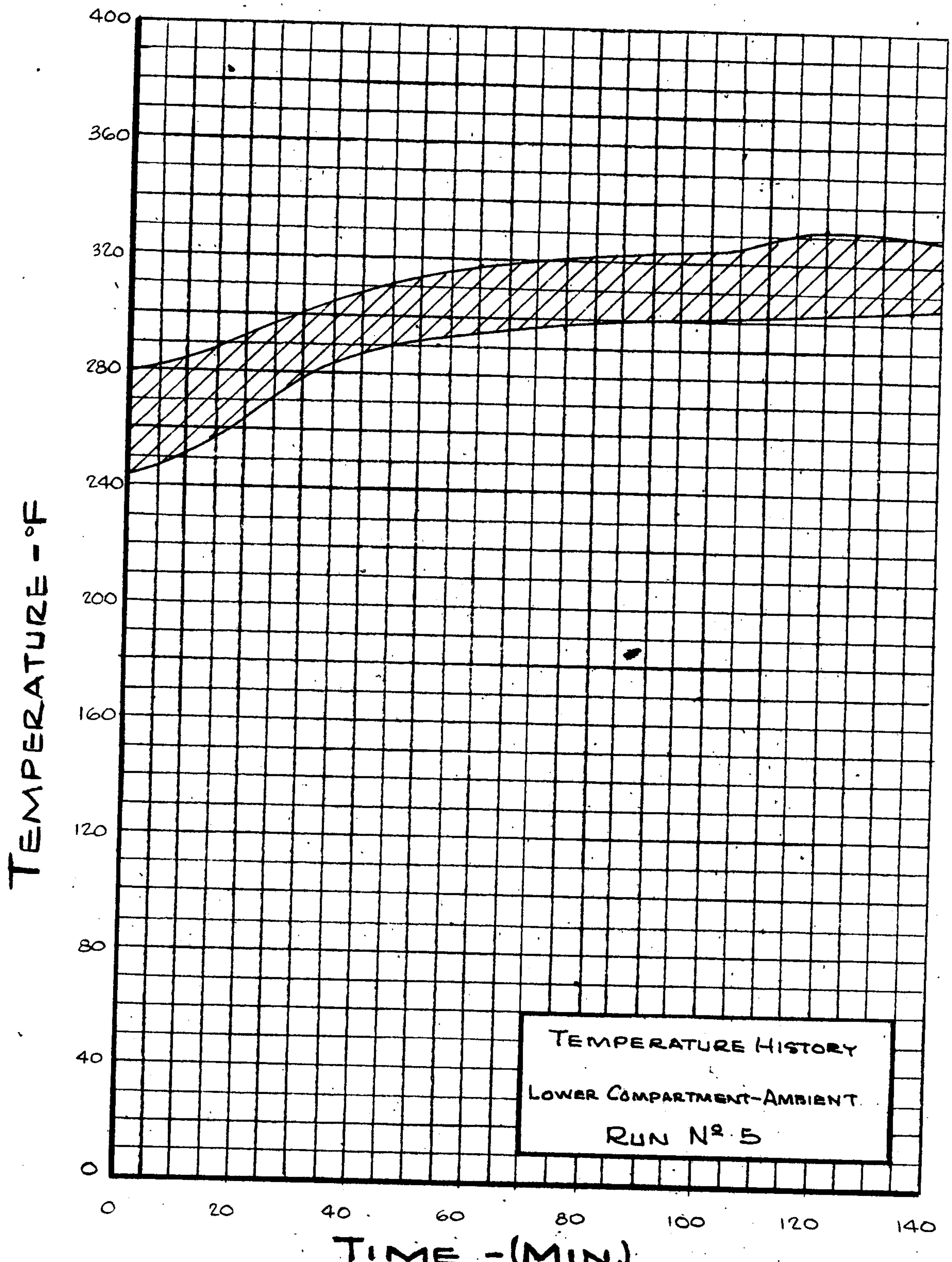


FIGURE Nº A30

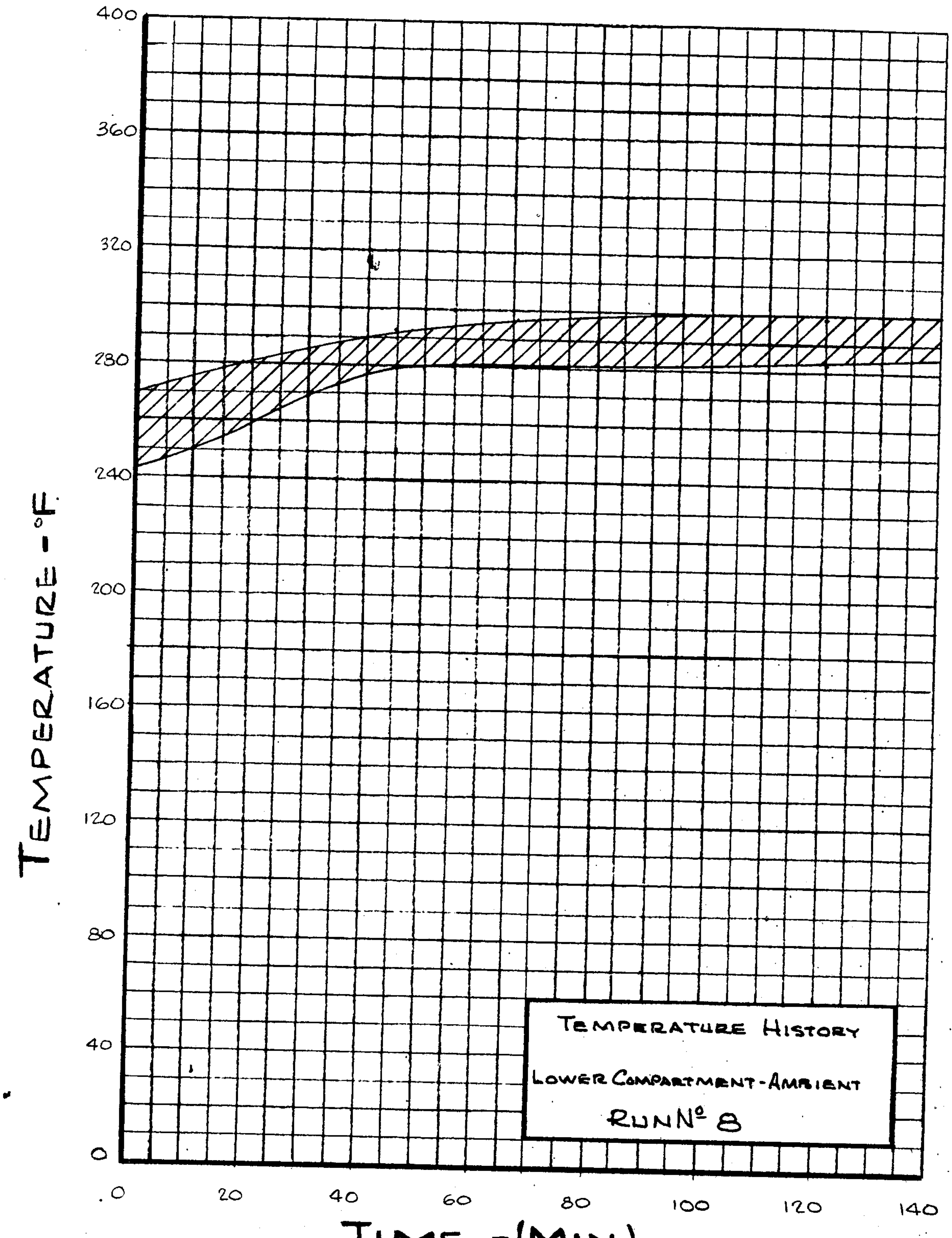


FIGURE Nº A31

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

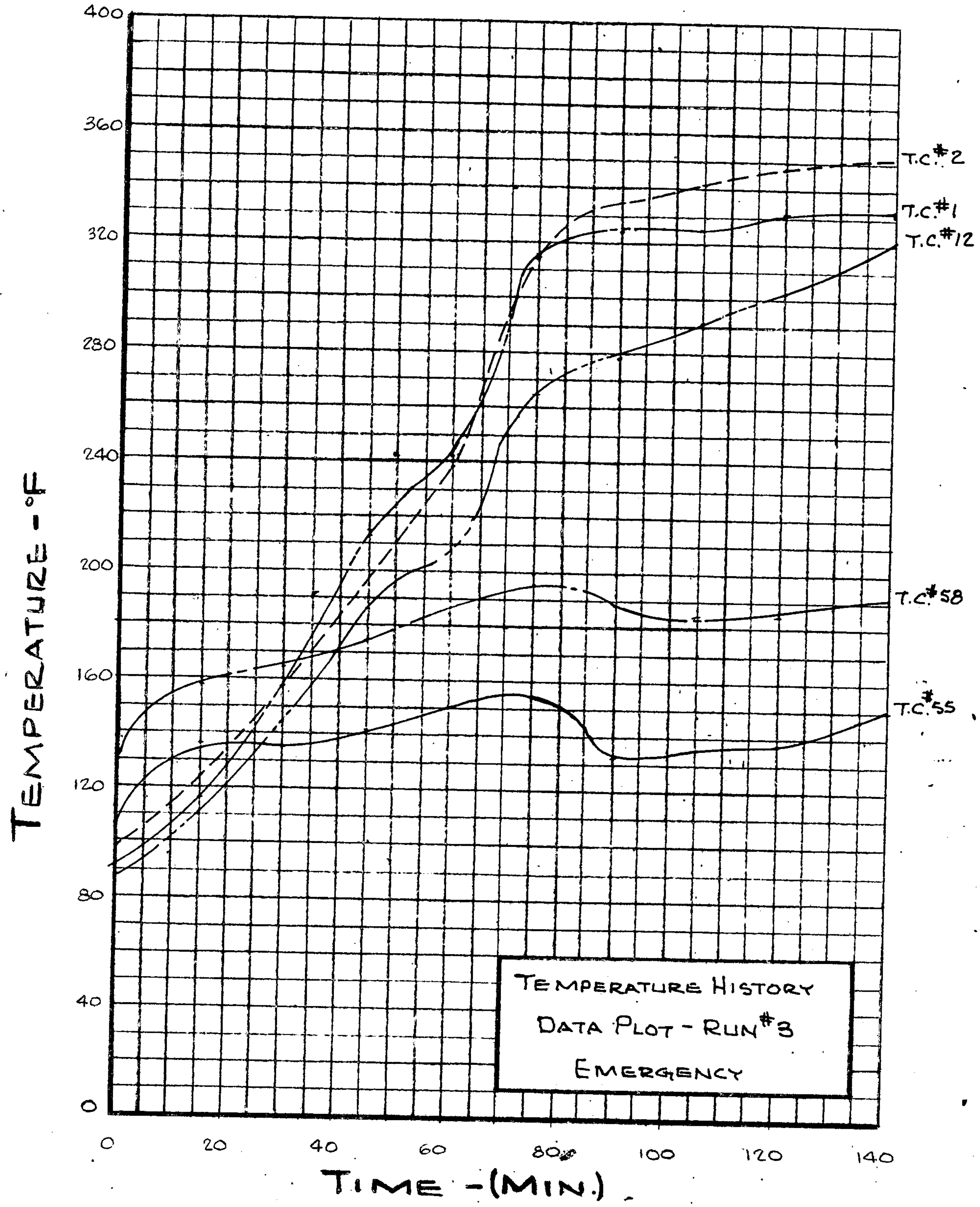


FIGURE Nº A32

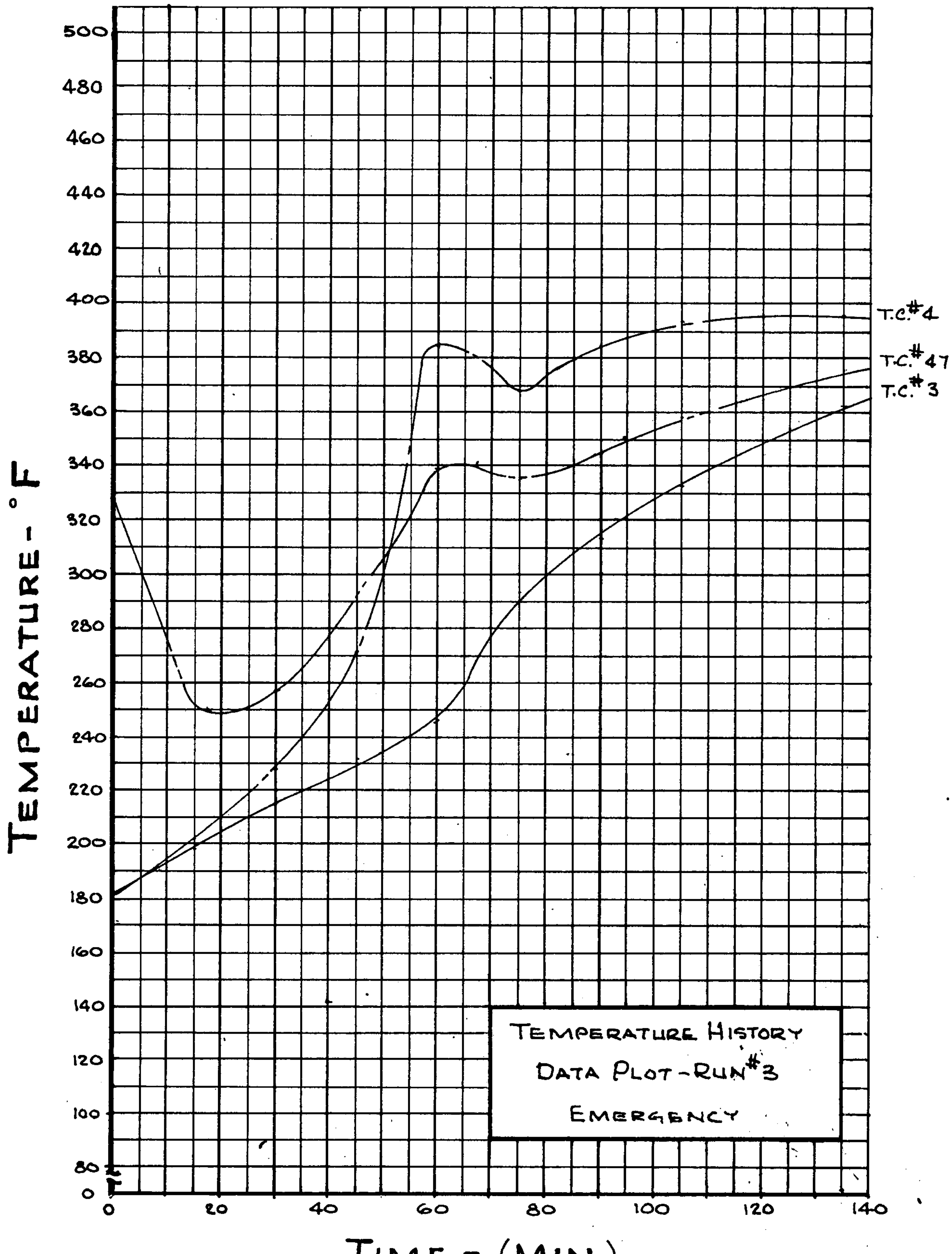


FIGURE Nº A33

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

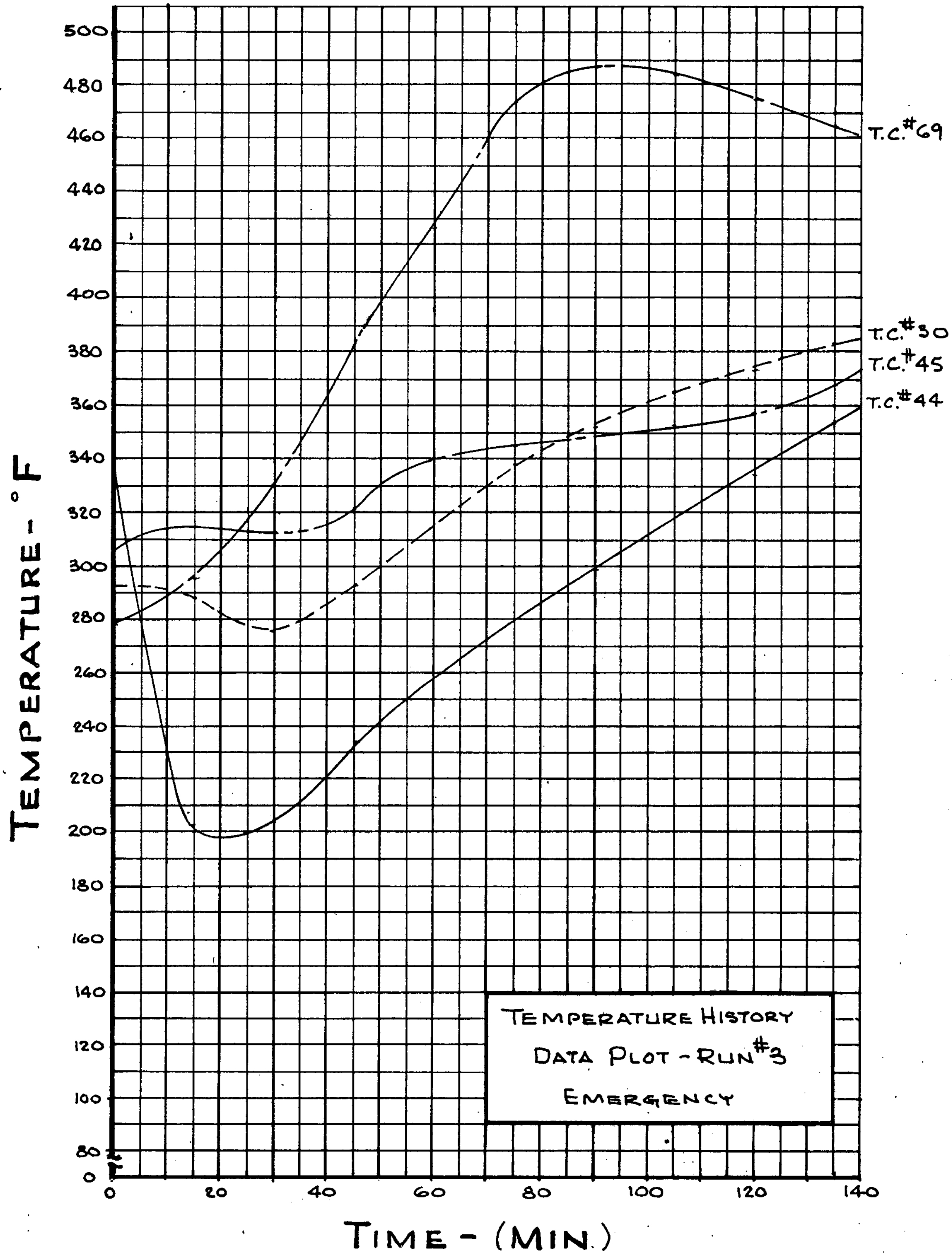


FIGURE Nº A34

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

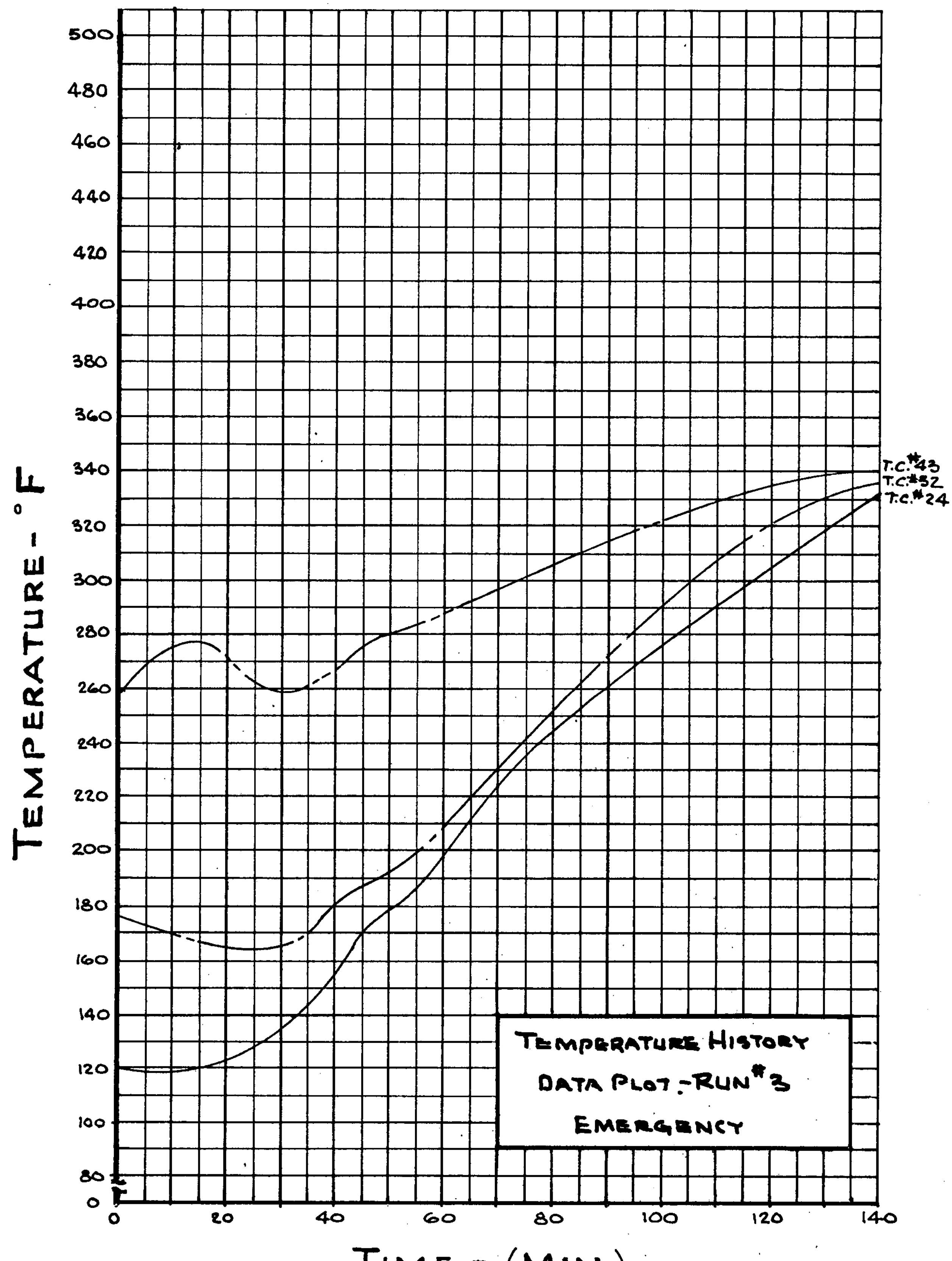


FIGURE Nº A35

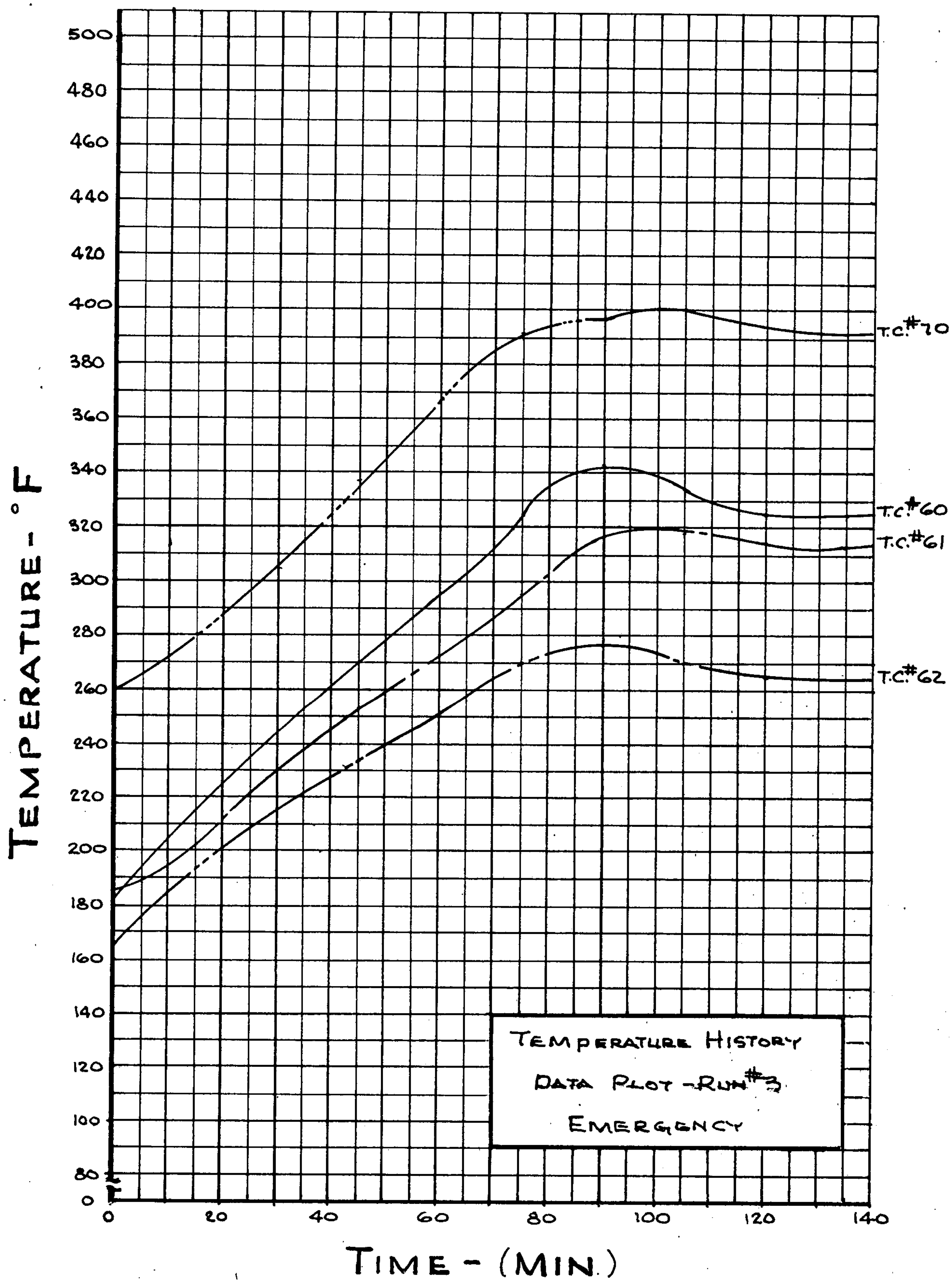


FIGURE Nº A36

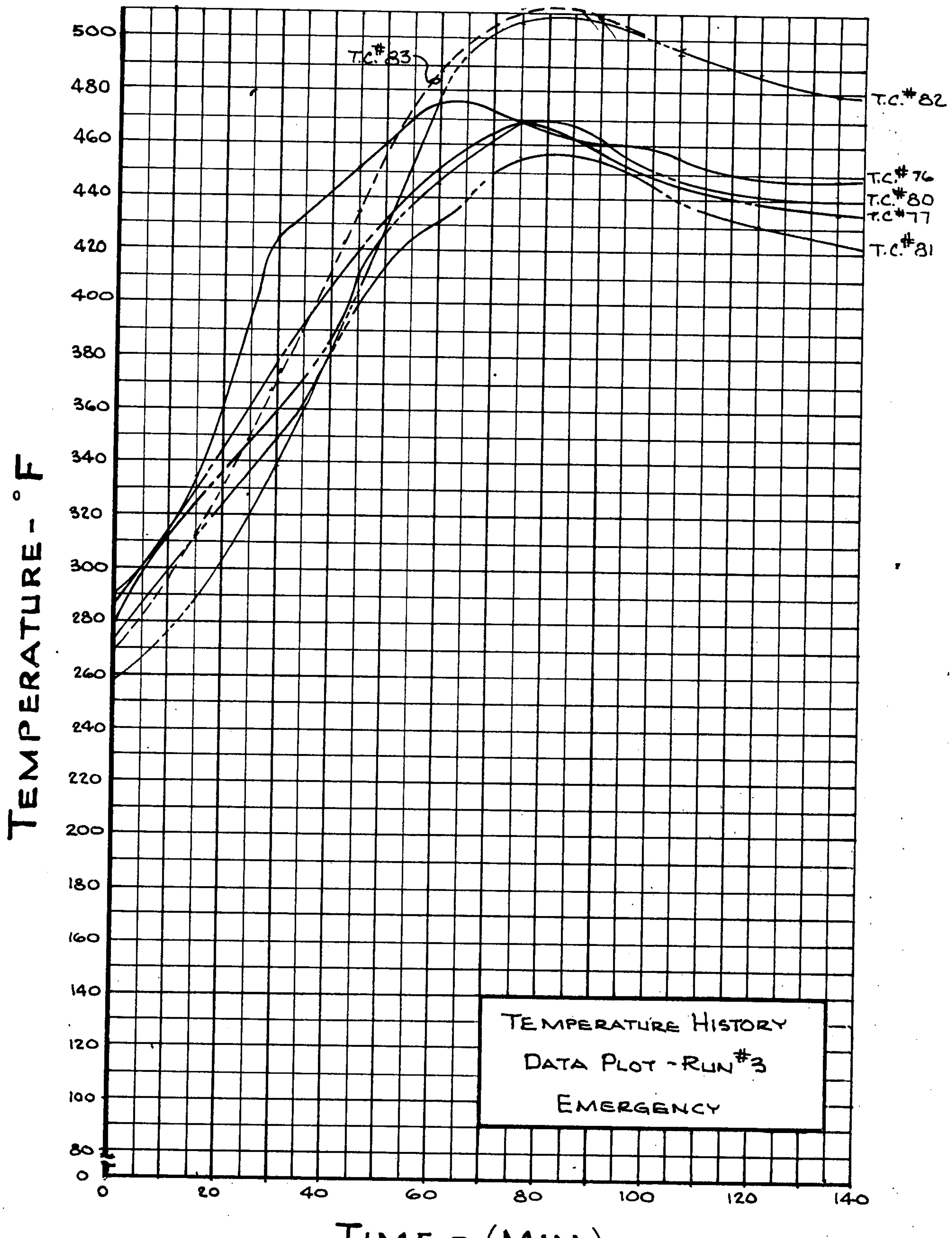


FIGURE Nº A37

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

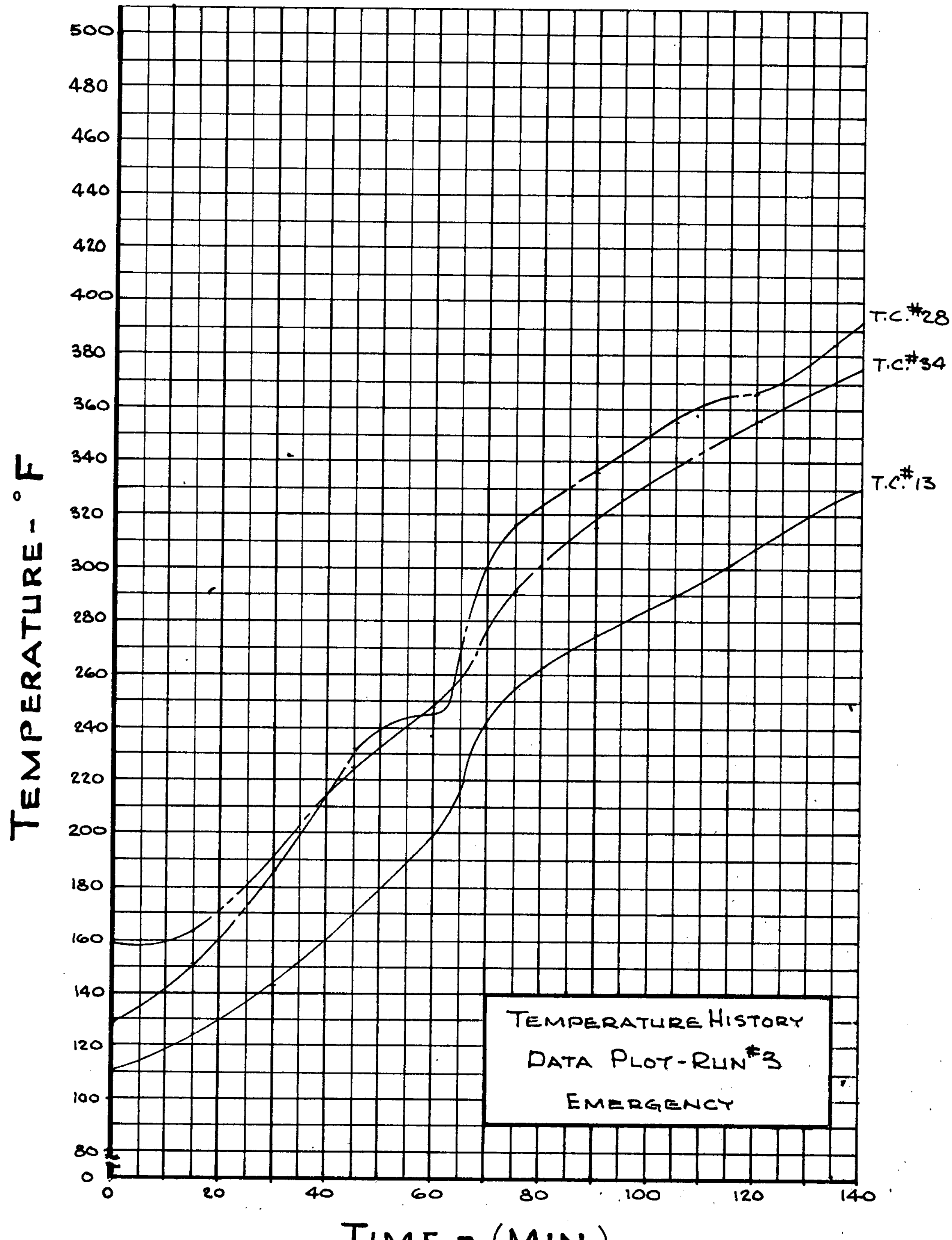


FIGURE Nº A38

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

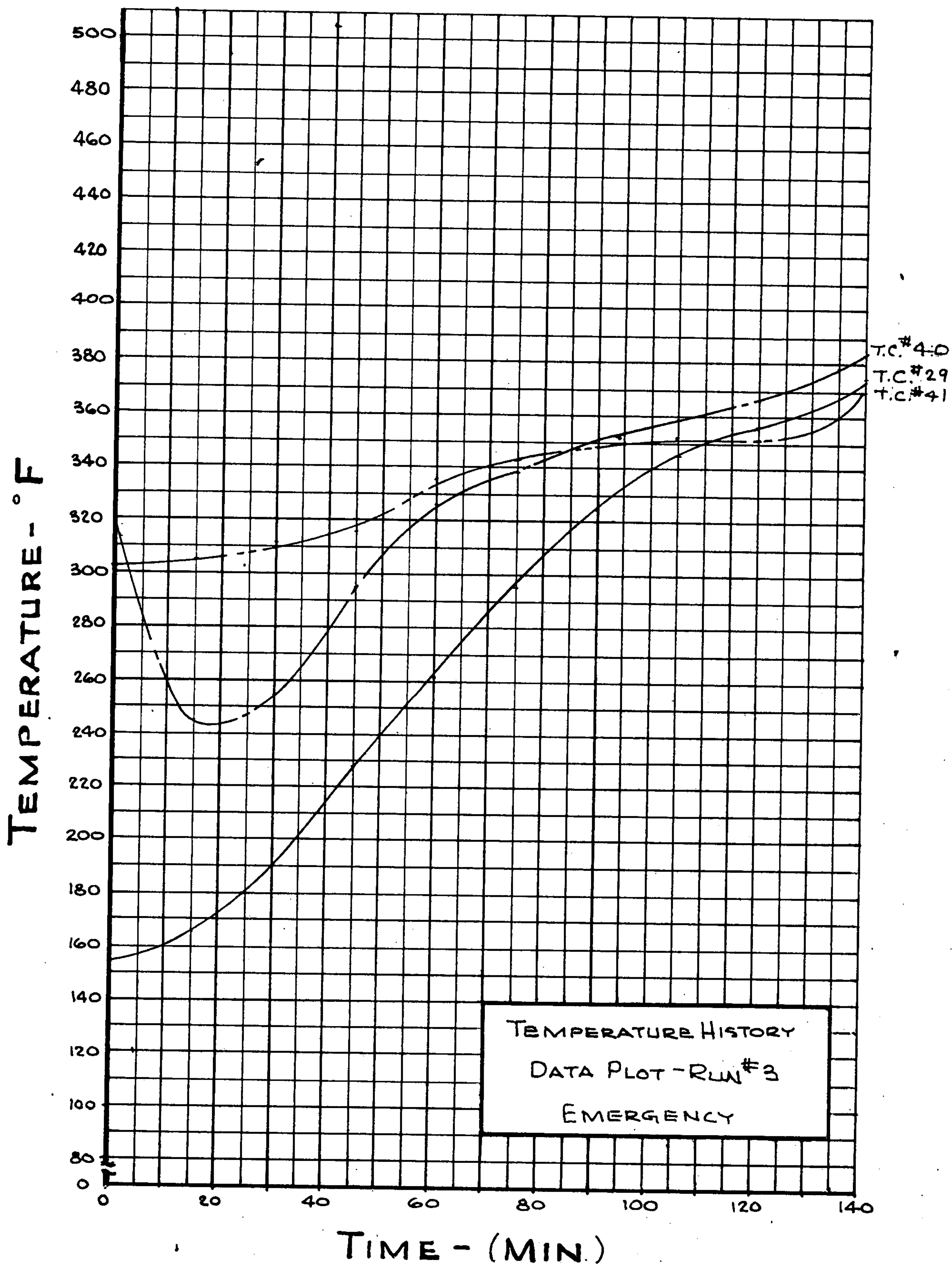


FIGURE Nº A39

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

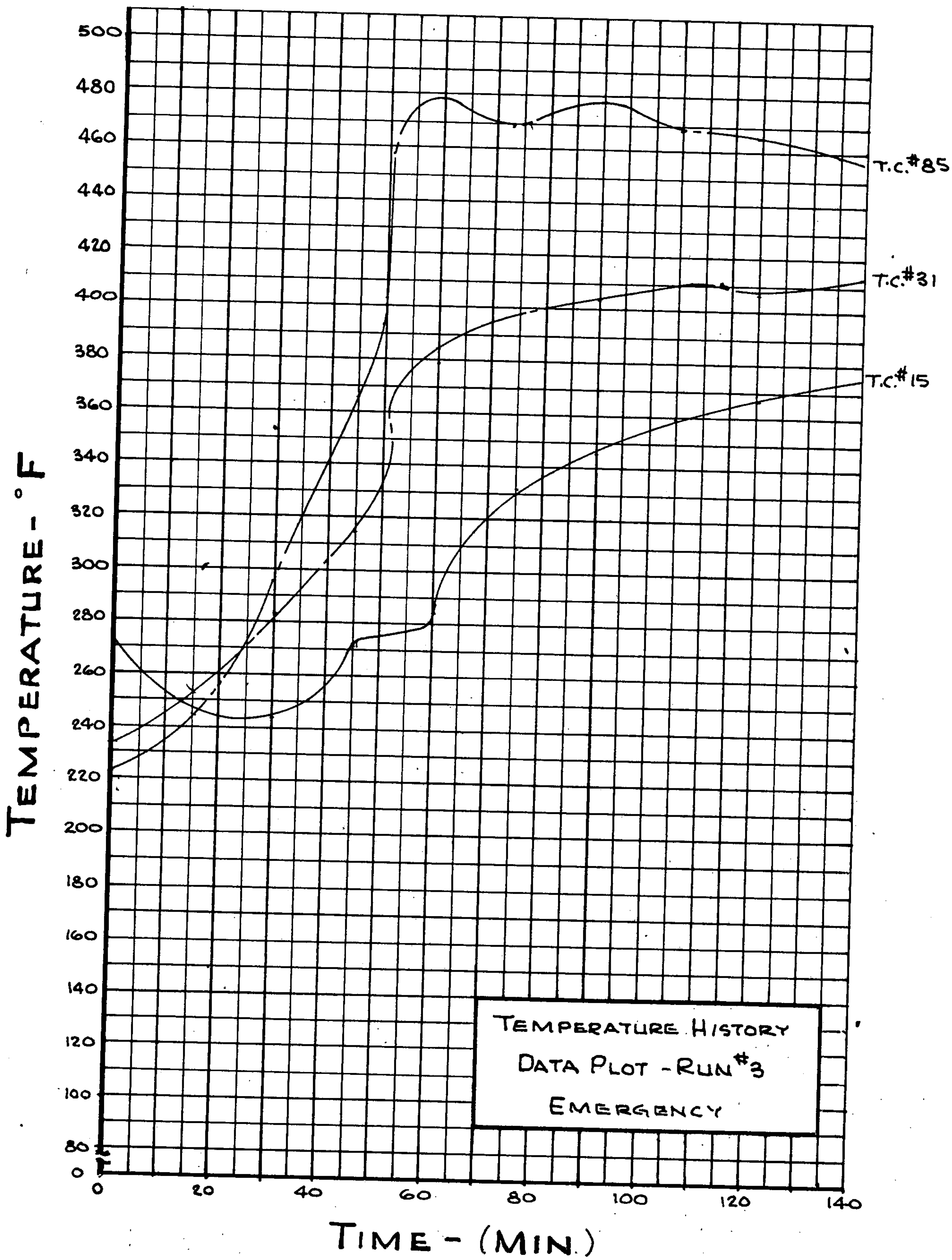


FIGURE Nº A40

△ METERED IN INCHES OF WATER ("H_2O)

TABLE N° A1

AIR FLOW - PRESSURE DATA

RUN Nº	TIME		ALT. (FEET)	W_1 (LBM/MIN)	W_2 (LBM/MIN)	P_1 ("HGA)	$_1\Delta P_2$ ("HG)	$_3\Delta P_4$ ("H_2O)	$_4\Delta P_5$ ("H_2O)	$_5\Delta P_6$ ("H_2O)	P_7 ("HGA)	$_7\Delta P_8$ ("H_2O)	$_9\Delta P_{12}$ ("H_2O)	$_{10}\Delta P_{12}$ ("H_2O)	P_{11} ("HGA)	P_{12} ("HGA)	$_{13}\Delta P_{12}$ ("H_2O)	P_{14} ("HGA)	$_{14}\Delta P_3$ ("H_2O)
PRE-TEST	1/10	14:30	SEA LEVEL	9.4	–	28.85	39.6 △	9.2	4.2	0.8	–	–	–	–	–	–	–	1.2	–
PRE-TEST	1/10	15:00	SEA LEVEL	9.4	–	28.88	39.0 △	8.9	3.65	5.86	–	–	–	–	–	–	–	1.1	–
PRE-TEST	1/10	15:30	SEA LEVEL	9.5	–	28.85	40.1 △	9.2	3.7	5.55	–	–	–	–	–	–	–	30.29	–
WARM UP	1/11	09:15	SEA LEVEL	9.5	–	32.45	3.0	6.97	14.95	1.89	29.23	–	–	–	29.23	29.23	–	30.1	1.30
WARM UP	1/11	09:30	SEA LEVEL	9.5	–	32.45	3.0	6.97	14.95	1.90	29.23	–	–	–	29.23	29.23	–	30.1	1.30
WARM UP	1/11	09:45	SEA LEVEL	9.5	–	32.45	3.0	6.98	14.90	1.90	29.23	–	–	–	29.23	29.23	–	30.1	1.30
WARM UP	1/11	10:00	SEA LEVEL	9.5	–	32.45	3.0	6.98	14.90	1.90	29.23	–	–	–	29.23	29.23	–	30.1	1.30
WARM UP	1/11	10:30	81,500	9.5	–	15.4	9.5	40.7	–	16.1	1.85	–	–	–	1.80	1.80	–	7.38	5.2
SEA LEVEL CHECK	1/11	15:20	SEA LEVEL	9.5	–	32.6	3.0	6.9	1.2	1.62	–	–	–	–	–	–	–	–	–
WARM UP	1/11	18:30	75,000	10.2	0	16.8	10.6	39.3	10.8	16.35	2.5	–	–	–	2.45	2.45	–	7.85	0.2
WARM UP	1/11	18:45	75,000	9.4	0	15.1	9.5	34.9	9.1	14.2	3.5	1.4	6.0	6.1	2.45	2.45	5.3	–	0.2
WARM UP	1/11	19:00	75,000	10.2	0	15.2	9.5	35.0	9.1	14.2	2.5	–	–	–	2.45	2.45	–	7.1	0.2
1	1/11	19:30	80,000	9.5	1.5	3.4	9.8	37.6	8.9	15.1	7.35	5.3	14.4	44.4	1.95	1.95	36.0	7.0	5.7
1	1/11	19:45	80,000	9.5	1.5	15.1	9.8	35.8	9.3	14.8	7.35	5.2	14.7	40.1	2.10	2.10	32.0	7.2	5.6
1	1/11	20:00	75,000	9.6	1.5	15.5	9.8	36.1	9.5	14.9	7.50	5.4	15.7	40.7	2.30	2.30	32.5	7.2	5.7
1	1/11	20:15	75,000	9.5	1.5	15.3	9.8	36.2	9.6	15.3	7.50	5.3	15.2	41.6	2.25	2.25	33.3	7.2	5.7
1	1/11	20:30	75,000	9.5	1.5	15.3	9.7	36.5	9.7	15.5	7.45	5.4	15.15	41.9	2.25	2.25	33.5	7.2	5.7
1	1/11	20:45	76,000	9.5	1.5	15.3	9.7	36.3	9.7	15.4	7.40	5.3	15.0	41.7	2.25	2.25	33.45	7.2	5.7
1	1/11	21:00	77,000	9.5	1.5	15.3	9.7	36.4	9.7	15.4	7.40	5.4	15.1	41.6	2.25	2.25	33.3	7.2	5.7
1	1/11	21:15	76,000	9.5	1.5	15.25	9.65	36.3	9.7	15.3	7.40	5.3	15.0	41.3	2.22	2.22	33.1	7.2	5.7
1	1/11	21:30	76,000	9.5	1.5	15.30	9.65	36.4	9.7	15.32	7.40	5.3	6.0	38.2	2.22	2.23	30.3	7.15	5.8
1	1/11	21:45	76,000	9.5	1.5	15.28	9.65	36.3	9.7	15.35	7.40	5.35	6.8	34.6	2.22	2.70	26.2	7.2	5.8
1	1/11	22:00	76,000	9.5	1.5	15.3	9.65	36.3	9.65	15.1	7.45	5.30	6.8	33.4	2.22	2.70	27.7	7.2	5.8
1	1/11	22:15	76,000	9.5	1.5	15.3	9.60	36.1	9.65	14.8	7.40	5.30	6.0	31.35	2.22	2.70	23.8	7.2	5.7
1	1/11	22:30	76,000	9.5	1.5	15.3	9.60	36.1	9.65	14.7	7.30	5.30	6.0	31.2	2.22	2.70	23.6	7.2	5.7
1	1/11	22:45	76,000	9.5	1.5	15.3	9.60	36.1	9.60	14.7	7.35	5.30	6.0	31.0	2.25	2.70	23.3	7.2	5.7
2	1/11	23:00	76,000	9.5	1.5	15.3	9.60	35.8	9.20	16.0	7.35	5.30	5.9	31.5	2.25	2.70	23.8	7.2	5.65
2	1/11	23:15	76,000	9.5	1.5	15.3	9.60	35.7	9.0	17.3	7.40	5.30	6.1	32.9	2.25	2.75	25.3	7.3	6.0
2	1/11	23:30	77,000	9.5	1.5	15.4	9.65	35.9	9.0	17.9	7.40	5.3	6.2	33.5	2.25	2.75	25.6	7.3	5.9
2	1/11	23:45	77,000	9.5	1.5	15.4	9.65	35.8	8.9	18.1	7.4	5.3	6.4	33.5	2.25	2.80	25.8	7.3	5.9
2	1/11	24:00	76,000	9.5	1.5	15.4	8.85	35.7	8.8	18.3	7.4	5.3	6.4	33.5	2.25	2.75	25.7	7.3	5.85
2	1/12	00:15	77,000	9.5	1.5	15.4	9.7	35.5	8.8	18.3	7.45	5.3	6.3	33.4	2.18	2.80	25.6	7.3	5.85

Approved For Release 2000/04/12 : CIA-RDP67B00657R000100210001-6

TABLE Nº A1

AIR FLOW - PRESSURE DATA

△ METERED IN INCHES OF WATER ("H_2O)

RUN Nº	TIME	ALT. (FEET)	W_1 (LBM/MIN)	W_2 (LBM/MIN)	P_1 ("HGA)	$_1\Delta P_2$ ("HG)	$_3\Delta P_4$ ("H_2O)	$_4\Delta P_5$ ("H_2O)	$_5\Delta P_6$ ("H_2O)	P_7 ("HGA)	$_7\Delta P_8$ ("H_2O)	$_9\Delta P_{12}$ ("H_2O)	$_{10}\Delta P_{12}$ ("H_2O)	P_{11} ("HGA)	P_{12} ("HGA)	$_{13}\Delta P_{12}$ ("H_2O)	P_{14} ("HGA)	$_{14}\Delta P_3$ ("H_2O)
2	1/12 00:30	75,000	9.5	1.5	15.4	9.7	35.5	8.8	18.3	7.45	5.3	6.4	33.7	2.18	2.80	25.8	7.3	5.8
2	1/12 00:45	75,000	9.5	1.5	15.4	9.7	35.5	8.7	18.4	7.45	5.4	6.4	33.5	2.2	2.80	25.6	7.3	5.8
2	1/12 01:00	75,000	9.5	1.5	15.4	9.7	35.5	8.6	18.4	7.45	5.3	6.35	33.4	2.2	2.80	25.6	7.3	5.8
2	1/12 01:15	75,000	9.5	1.5	15.4	9.65	35.4	8.6	18.4	7.45	5.3	6.4	33.4	2.2	2.80	25.5	7.3	5.8
2	1/12 01:30	75,000	9.5	1.5	15.4	9.65	35.4	8.6	18.4	7.45	5.3	6.4	33.5	2.2	2.80	25.5	7.3	5.8
3	1/12 01:45	75,000	-	.75	3.8	1.80	3.0	2.5	4.3	4.2	2.9	2.45	5.5	1.7	2.6	2.85	2.4	1.7
3	1/12 02:00	75,000	-	.75	2.2	1.75	3.7	2.05	3.9	4.2	2.3	2.2	5.85	1.7	2.6	3.15	1.75	0
3	1/12 02:15	75,000	-	.75	2.6	1.1	1.2	1.6	2.3	4.2	2.8	8.2	11.8	1.3	2.5	9.9	1.4	3.1
3	1/12 02:30	75,000	-	.75	1.5	.05	0	1.7	.95	4.2	2.2	10.95	15.1	1.1	1.8	11.95	1.2	2.8
3	1/12 02:45	75,000	.71	.75	1.5	△ 4.75	0	1.25	.85	4.4	2.6	11.2	13.7	1.3	1.9	11.3	1.4	1.5
3	1/12 03:00	75,000	.71	.75	1.6	△ 4.4	0	1.3	.90	4.4	2.1	11.3	13.0	1.3	1.9	10.3	1.3	1.4
3	1/12 03:15	87,000	.71	.75	1.3	△ 5.5	0	2.0	1.50	4.3	2.2	13.1	18.9	0.7	1.6	14.7	1.1	1.5
3	1/12 03:30	86,000	.71	.75	1.3	△ 5.5	0	1.8	1.3	4.2	2.7	12.2	16.8	0.7	1.6	13.4	1.1	1.7
3	1/12 03:45	86,000	.71	.75	1.2	△ 5.6	0	1.8	1.3	4.1	2.7	12.5	12.5	0.7	1.6	14.1	1.1	1.7
3	1/12 04:00	86,000	.71	.75	1.2	△ 5.5	0	1.8	1.3	4.1	2.7	12.4	16.5	0.7	1.6	13.3	1.1	1.9
3	1/12 04:15	86,000	.71	.75	1.25	△ 5.4	0	1.8	1.3	4.1	2.7	12.4	15.6	0.7	1.65	12.3	1.1	1.8
3	1/12 04:30	90,000	.71	.75	1.25	△ 5.6	0	1.9	1.4	4.1	2.7	12.2	16.8	0.7	1.6	13.4	1.1	1.9
3	1/12 04:45	90,000	.71	.75	1.25	△ 5.6	0	1.9	1.4	4.1	2.7	12.6	18.9	0.7	1.5	15.1	1.1	1.9
4	1/12 05:00	86,500	7.50	1.50	11.8	7.3	25.7	6.9	15.5	7.8	5.5	14.3	51.0	1.7	1.7	42.9	5.8	4.5
4	1/12 05:15	86,500	7.50	1.50	11.4	7.0	24.6	6.6	13.6	7.5	5.4	12.1	46.8	1.8	1.7	39.1	5.6	4.3
4	1/12 05:30	86,500	7.50	1.50	11.4	7.1	25.0	6.8	12.9	7.5	5.4	11.9	45.3	1.8	1.83	37.6	5.6	4.3
4	1/12 05:45	88,000	7.50	1.50	11.4	7.1	25.3	6.9	12.5	7.45	5.4	11.8	44.0	1.8	1.9	36.3	5.55	4.3
4	1/12 06:00	88,000	7.50	1.50	11.4	7.1	25.3	6.9	12.1	7.45	5.4	11.8	42.8	1.8	1.9	35.0	5.55	4.3
4	1/12 06:15	88,000	7.50	1.50	11.4	7.1	25.35	7.0	12.0	7.50	5.5	11.8	42.0	1.8	2.0	34.2	5.55	4.3
4	1/12 06:30	88,000	7.50	1.50	11.4	7.1	25.4	7.05	11.9	7.50	5.5	11.8	41.0	1.8	2.0	33.3	5.54	4.3
4	1/12 06:45	88,000	7.50	1.50	11.4	7.1	25.4	7.1	11.8	7.50	5.5	11.84	39.9	1.8	2.2	32.1	5.54	4.25
4	1/12 07:00	88,000	7.50	1.50	11.4	7.1	25.4	7.1	11.7	7.50	5.5	11.8	39.0	1.7	2.1	31.2	5.54	4.3
4	1/12 07:15	88,000	7.50	1.50	11.1	7.0	24.5	6.9	11.3	7.20	5.3	10.6	36.0	1.7	2.2	28.6	5.4	4.2
4	1/12 07:30	88,000	7.50	1.50	11.1	6.9	24.5	6.9	11.3	7.20	5.3	10.6	35.5	1.7	2.2	28.0	5.4	4.2
4	1/12 07:45	88,000	7.50	1.50	11.1	6.9	24.6	6.9	11.3	7.20	5.3	10.7	34.6	1.7	2.35	27.1	5.3	4.1
5	1/12 08:00	88,000	7.50	1.50	11.1	6.9	24.1	6.5	12.8	7.20	5.3	11.0	34.1	1.7	2.4	26.6	5.4	4.2
5	1/12 08:15	88,000	7.50	1.50	11.1	6.9	23.9	6.3	13.7	7.20	5.3	11.2	33.8	1.5	2.3	26.3	5.4	4.2
5	1/12 08:30	88,000	7.50	1.50	11.1	6.9	23.9	6.2	14.1	7.20	5.3	11.3	33.6	1.7	2.4	26.0	5.4	4.2
5	1/12 08:45	90,000	7.50	1.50	11.1	6.9	23.7	6.0	14.4	7.20	5.3	11.4	33.6	1.7	2.45	26.0	5.4	4.2
5	1/12 09:00	90,000	7.50	1.50	11.1	6.9	23.6	6.0	14.5	7.20	5.3	11.4	33.6	1.7	2.45	26.0	5.4	4.3
5	1/12 09:15	90,000	7.50	1.50	11.1	6.9	23.6	6.0	14.5	7.20	5.3	11.4	33.8	1.7	2.40	26.2	5.5	5.0

△ METERED IN INCHES OF WATER ("H_2O)

TABLE Nº A1

AIR FLOW – PRESSURE DATA

RUN Nº	TIME	ALT. (FEET)	W_1 (LBM/MIN)	W_2 (LBM/MIN)	P_1 ("HGA)	${}_1\Delta P_2$ ("HG)	${}_3\Delta P_4$ ("H_2O)	${}_4\Delta P_5$ ("H_2O)	${}_5\Delta P_6$ ("H_2O)	P_7 ("HGA)	${}_7\Delta P_8$ ("H_2O)	${}_9\Delta P_{12}$ ("H_2O)	${}_{10}\Delta P_{12}$ ("H_2O)	P_{11} ("HGA)	P_{12} ("HGA)	${}_{13}\Delta P_{12}$ ("H_2O)	P_{14} ("HGA)	${}_{19}\Delta P_3$ ("H_2O)
5	1/12 09:30	90,000	7.50	1.50	11.1	6.9	23.6	6.0	14.2	7.25	5.3	11.4	33.4	1.75	2.55	26.0	5.5	5.0
5	1/12 09:45	90,000	7.50	1.50	11.8	7.2	25.6	6.5	15.0	7.6	5.4	13.4	36.0	1.75	2.6	28.1	5.8	5.4
5	1/12 10:00	90,000	7.50	1.50	11.8	7.2	25.8	6.5	15.1	7.6	5.4	13.6	36.5	1.75	2.6	28.5	5.8	5.3
5	1/12 10:15	90,000	7.50	1.50	11.8	7.2	25.9	6.6	15.2	7.6	5.4	13.6	37.2	1.75	2.5	29.0	5.8	5.3
5	1/12 10:30	90,000	7.50	1.50	11.85	7.3	26.0	6.6	15.2	7.6	5.6	13.7	37.0	1.7	2.55	28.9	5.8	5.3
5	1/12 10:45	90,000	7.50	1.50	11.9	7.4	26.0	6.6	15.1	7.6	5.6	13.5	37.1	1.7	2.5	29.0	5.8	5.3
5	1/12 11:00	90,000	7.50	1.50	11.9	7.4	26.0	6.6	15.2	7.6	5.6	13.5	37.0	1.7	2.5	29.0	5.8	5.3
5	1/12 11:15	90,000	7.50	1.50	11.9	7.4	26.0	6.6	15.2	7.6	5.6	13.5	37.0	1.7	2.5	29.0	5.8	5.3
5	1/12 11:30	90,000	7.50	1.50	11.9	7.4	26.0	6.7	14.5	7.6	5.6	13.1	36.9	1.7	2.5	28.8	5.8	5.3
6A	1/12 12:45	90,000	0.90	0.60	1.7	△22.0	—	2.3	2.1	2.1	—	—	—	—	1.2	—	—	—
6A	1/12 13:30	90,000	4.0	0.93	5.3	△32.2	6.8	2.8	4.4	9.6	8.2	—	49.3	1.6	2.4	47.7	2.7	1.8
6A	1/12 13:45	90,000	4.0	0.9	5.6	△39.3	8.3	2.9	5.3	13.2	10.0	11.9	60+	1.7	2.6	60+	3.4	3.4
6A	1/12 14:00	90,000	4.0	0.9	5.6	△39.3	8.3	2.9	5.3	13.2	10.0	11.9	60+	1.7	2.6	60+	3.4	3.4
6A	1/12 16:00	90,000	0.9	0.6	2.1	△9.3	—	2.2	2.2	6.65	4.6	—	39.7	1.1	1.6	33.0	1.8	2.4
6A	1/12 17:00	78,000	0.91	0.6	2.1	△9.4	0.4	1.7	1.9	3.2	1.9	—	7.1	1.3	1.7	7.9	1.8	3.7
6A	1/12 17:28	78,000	0.91	0.6	2.05	△8.9	0.4	1.6	1.9	3.1	1.85	—	4.25	1.25	1.8	6.2	1.8	3.65
6A	1/12 19:00	85,000	0.91	0.6	2.2	△11.7	0.9	2.0	2.85	3.1	1.85	10.2	10.7	1.05	1.8	7.3	1.8	3.95
6A	1/12 19:30	75,000	0.91	0.6	2.35	△10.6	1.1	1.45	2.1	3.1	1.7	10.4	9.6	1.3	1.3	9.3	1.9	3.4
6A	1/12 19:45	75,000	0.91	0.6	2.3	△10.5	0.95	1.5	2.2	3.1	1.85	9.2	7.9	1.35	1.5	9.0	1.9	3.25
6A	1/12 20:00	75,000	0.91	0.6	2.3	△10.5	0.95	1.5	2.2	3.2	1.8	8.3	6.65	1.35	1.6	8.95	1.9	3.25
6A	1/12 20:15	75,000	0.91	0.6	2.3	△10.6	0.95	1.5	2.25	3.2	1.8	8.2	6.4	1.35	1.6	8.3	1.9	3.2
6B	1/12 20:30	88,000	0.9	0.6	2.3	△11.9	0.95	1.9	2.96	3.15	2.8	10.6	10.7	1.02	1.3	7.8	1.9	3.7
6B	1/12 20:45	88,000	0.9	0.6	2.3	△11.9	0.95	1.9	2.90	3.15	2.8	10.6	10.7	1.02	1.3	7.8	1.9	3.7
6B	1/12 21:00	88,000	0.9	0.6	2.3	△11.9	0.95	1.9	2.90	3.15	2.8	10.6	10.7	1.02	1.3	7.8	1.9	3.7
6B	1/12 21:15	88,000	0.9	0.6	2.15	△11.8	1.0	1.9	2.8	3.15	1.9	10.1	11.0	1.1	1.3	8.2	1.8	3.7
6B	1/12 21:30	88,000	—	0.6	2.5	△14.2	2.1	1.8	3.4	3.1	1.9	10.8	10.8	1.1	1.3	8.6	1.8	3.8
6B	1/12 21:45	88,000	—	0.6	2.6	△15.2	2.0	1.9	3.4	3.1	1.8	10.1	9.2	1.1	1.3	8.7	1.8	3.5
6B	1/12 22:00	88,000	0.9	0.6	2.2	△12.3	0.9	2.0	2.9	3.4	1.2	11.7	13.8	1.05	1.3	11.9	1.8	3.6
6B	1/12 22:15	88,000	1.5	0.6	2.7	△16.2	2.8	1.7	3.6	3.4	2.0	12.2	12.8	1.2	1.3	10.9	2.2	4.8

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TABLE N° A1

AIR FLOW - PRESSURE DATA

RUN N°	TIME	ALT. (FEET)	W_1 (LBM/MIN)	W_2 (LBM/MIN)	P_1 ("HGA)	$_1\Delta P_2$ ("HG)	$_3\Delta P_4$ ("H_2O)	$_4\Delta P_5$ ("H_2O)	$_5\Delta P_6$ ("H_2O)	P_7 ("HGA)	$_7\Delta P_8$ ("H_2O)	$_9\Delta P_{12}$ ("H_2O)	$_{10}\Delta P_{12}$ ("H_2O)	P_{11} ("HGA)	P_{12} ("HGA)	$_{13}\Delta P_{12}$ ("H_2O)	P_{14} ("HGA)	$_{13}\Delta P_3$ ("H_2O)
6B	1/12 22:30	88,000	0.9	0.6	3.1	Δ 19.3	3.2	2.0	3.9	3.45	2.0	11.2	11.6	1.25	1.4	10.9	2.0	3.25
6B	1/12 22:45	88,000	0.915	0.61	2.1	Δ 12.45	7.0	1.9	2.6	3.45	2.0	12.4	13.6	1.1	1.3	10.4	1.8	3.5
6B	1/12 23:00	88,000	0.915	0.61	2.3	Δ 13.1	1.3	1.85	2.9	3.45	2.0	12.05	12.1	1.1	1.3	10.25	1.8	3.5
7	1/13 00:30	75,000	9.0	1.5	12.5	7.5	28.4	7.7	10.7	7.8	5.3	15.7	40.2	2.4	2.3	32.2	6.1	4.7
7	1/13 00:45	75,000	9.0	1.5	12.3	7.5	26.9	7.25	11.6	7.4	5.3	14.2	35.2	2.4	2.5	29.6	6.1	5.0
8	1/13 01:00	75,000	9.0	1.5	12.3	7.5	26.7	7.1	12.1	7.4	5.2	14.4	33.7	2.4	2.6	29.6	6.15	5.1
8	1/13 01:15	75,000	9.0	1.5	12.3	7.5	26.5	7.0	12.4	7.35	5.3	14.2	33.4	2.3	2.6	29.0	6.15	4.9
8	1/13 01:30	79,000	9.0	1.5	12.3	7.5	26.4	7.0	12.7	7.35	5.2	14.1	33.7	2.2	2.55	28.4	6.0	4.7
8	1/13 01:45	79,000	9.0	1.5	12.2	7.5	26.85	7.0	13.3	7.35	5.1	14.1	35.0	2.15	2.5	28.4	6.0	5.1
8	1/13 02:00	75,000	9.0	1.5	12.15	7.4	25.7	6.6	12.2	7.35	5.1	14.0	34.0	2.5	2.55	28.5	6.1	4.8
8	1/13 02:15	80,000	9.0	1.5	12.4	7.5	27.2	7.1	13.4	7.4	5.2	14.3	35.4	2.15	2.55	28.7	6.0	5.2
8	1/13 02:30	81,000	9.0	1.5	12.3	7.5	27.0	7.15	13.4	7.4	5.3	14.9	35.0	2.15	2.50	28.2	6.0	5.0

TEST DATA - RUN Nº 2
TABLE Nº A2

TEST CONDITION: STABILIZATION - SYSTEM ENERGIZED.

DATE 1-11-64 START 2230 HR. END 0130 HR.

COOLING AIR FLOW:

3" DIA. INLET 9.5 #/MIN., 2" DIA. INLET 1.5 #/MIN.

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=75 °F	T=105 °F
1	81	83	85	86	88	88
2	86	90	92	94	97	97
3	113	130	152	161	174	179
4	118	133	153	162	175	179
5	80	82	84	86	89	90
6	84	94	97	99	101	108
7	85	91	94	96	98	99
8	92	93	101	105	111	113
9	90	94	99	102	107	109
10	92	101	108	101	114	117
11	92	98	101	102	106	107
12	81	82	85	85	87	88
13	86	91	93	100	105	106
14	113	130	152	161	174	179
15	139	194	232	246	265	273
16	137	157	185	200	219	227
17	79	82	85	87	88	89
18	82	89	94	95	96	98
19	88	95	103	105	112	113
20	87	96	101	104	109	111
21	78	81	84	85	88	90
22	82	87	88	90	91	92
23	86	89	94	95	99	100
24	85	86	95	100	107	110
25	112	118	151	166	185	192

TABLE № A2
TEST DATA - RUN № 2
(CONTINUED)

T.C. №	T= 135 °F	T= 165 °F	T= °F	T= °F	T= °F	T= °F
1	89	88				
2	98	98				
3	181	182				
4	181	182				
5	90	90				
6	109	108				
7	99	100				
8	114	114				
9	109	110				
10	117	118				
11	108	109				
12	89	89				
13	110	110				
14	181	182				
15	277	277				
16	232	232				
17	91	90				
18	98	98				
19	123	126				
20	111	112				
21	90	90				
22	95	95				
23	104	104				
24	111	122				
25	195	196				

TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 75 °F	T= 105 °F
26	91	99	108	111	117	119
27	83	85	89	89	93	93
28	99	109	119	122	129	132
29	102	118	131	137	145	148
30	138	180	231	252	280	292
31	182	195	210	216	227	232
32	96	99	132	146	164	170
33	100	106	124	134	158	163
34	102	126	139	145	152	157
35	108	112	140	154	172	178
36	117	142	174	188	206	214
37	112	137	151	163	171	176
38	113	125	141	151	164	169
39	104	129	143	150	160	163
40	132	242	283	297	317	324
41	148	212	269	291	322	333
42	104	142	170	181	198	205
43	106	124	185	208	239	250
44	102	227	305	317	333	340
46	134	171	237	260	292	304
46	138	180	231	252	280	292
47	128	237	281	297	318	328
48	152	172	212	231	258	268
49	128	138	210	243	284	298
50	133	160	217	242	276	290

TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 135 °F	T= 165 °F	T= °F	T= °F	T= °F	T= °F
26	121	122				
27	94	94				
28	133	134				
29	150	150				
30	297	299				
31	234	234				
32	172	174				
33	166	167				
34	159	158				
35	181	183				
36	218	218				
37	178	178				
38	171	172				
39	165	166				
40	328	327				
41	339	340				
42	208	209				
43	255	257				
44	344	344				
45	310	311				
46	297	299				
47	332	332				
48	275	276				
49	304	306				
50	295	298				

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TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 75 °F	T= 105 °F
51	114	146	190	210	238	250
52	145	192	249	264	283	289
53	126	186	255	282	318	330
54	115	117	120	122	127	130
55	97	100	101	103	105	108
56	249	258	270	276	286	290
57	110	113	116	117	122	123
58	116	120	123	125	130	132
59	115	118	121	123	128	129
60	152	153	162	166	177	180
61	156	156	162	167	178	183
62	139	142	148	152	159	162
63	235	239	253	260	273	276
64	225	325	355	367	376	380
65	186	192	204	211	222	227
66	188	195	204	209	218	222
67	175	180	188	192	201	204
68	155	160	167	172	180	185
69	219	230	247	255	269	275
70	210	213	230	240	252	257
71	199	200	220	233	251	257
72	256	260	270	278	290	296
73	283	284	294	300	309	312
74	222	227	240	249	260	264
76	247	251	262	267	280	284

TABLE Nº A2

TEST DATA - RUN Nº 2

(CONTINUED)

T.C. Nº	T= 135 °F	T= 165 °F	T= °F	T= °F	T= °F	T= °F
51	254	256				
52	294	294				
53	336	338				
54	130	130				
55	107	106				
56	291	292				
57	125	124				
58	133	132				
59	130	128				
60	183	183				
61	185	185				
62	164	164				
63	277	277				
64	382	383				
65	230	230				
66	224	224				
67	205	205				
68	186	185				
69	277	278				
70	258	260				
71	259	266				
72	298	299				
73	312	313				
74	265	266				
75	285	286				

TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T=75 °F	T=105 °F
76	235	243	262	270	284	289
77	240	246	260	267	279	284
78	253	258	270	278	288	293
79	180	197	222	232	248	253
80	234	245	259	265	278	282
81	232	243	257	263	266	277
82	206	224	247	257	271	277
83	216	225	241	249	262	266
84	182	195	210	216	227	232
85	156	170	189	198	210	216
86	213	216	220	224	229	232
87	180	196	247	275	311	322
88	322	327	341	348	360	364
89	232	240	263	277	295	303
90	159	200	249	265	287	295
91	186	289	327	339	352	359
92	270	278	289	294	300	303
93	280	291	307	314	325	294
94	161	180	220	240	269	281
95	181	202	239	255	277	285
96	295	300	313	322	333	339
97	157	165	188	200	215	222
98	303	304	312	319	329	335
99	275	279	291	297	307	311
100	155	159	166	170	176	179

TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 135 °F	T= 165 °F	T= °F	T= °F	T= °F	T= °F
76	291	290				
77	285	286				
78	295	295				
79	257	257				
80	283	283				
81	279	279				
82	279	280				
83	268	269				
84	234	234				
85	218	218				
86	233	234				
87	330	322				
88	367	367				
89	306	308				
90	300	301				
91	363	363				
92	303	305				
93	297	297				
94	286	289				
95	288	290				
96	342	342				
97	223	224				
98	336	337				
99	314	315				
100	181	182				

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TABLE Nº A2
TEST DATA - RUN Nº 2
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 75 °F	T=105 °F
101	266	279	293	300	311	317
102	270	278	289	294	300	276
103	223	235	257	266	282	285
104	195	221	247	258	272	279
105	121	123	126	127	132	134
106	128	127	129	131	133	135
107	138	145	155	160	166	170
108	139	144	148	157	162	165
109	216	222	236	245	255	257
110						
111						
112						
113						
114						
115						

TABLE Nº A2

TEST DATA - RUN Nº 2

(CONTINUED)

T.C. Nº	T= 135 °F	T= 165 °F	T= °F	T= °F	T= °F	T= °F
101	318	319				
102	279	281				
103	290	290				
104	282	283				
105	134	134				
106	136	136				
107	172	172				
108	166	167				
109	262	263				
110						
111						
112						
113						
114						
115						

TEST DATA - RUN Nº 3
TABLE Nº A3

TEST CONDITION: STABILIZATION - EMERGENCY
DATE 1-12-64 START 0115 HR. END 0415 HR.
COOLING AIR FLOW:
3" DIA. INLET ______ #/MIN. , 2" DIA. INLET 0.75 #/MIN.

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
1	88	115	156	215	238	318
2	98	122	160	214	242	317
3	182	198	214	231	247	293
4	182	202	228	271	385	368
5	90	106	142	215	282	324
6	104	123	157	200	226	299
7	101	121	158	206	231	311
8	114	138	158	243	268	262
9	110	132	166	220	261	322
10	118	141	176	223	259	321
11	109	134	176	224	262	335
12	88	110	143	186	204	265
13	109	124	144	174	188	229
14	182	198	214	231	247	293
15	272	244	243	272	283	331
16	234	238	233	269	297	336
17	90	107	134	169	174	211
18	98	110	137	172	174	203
19	127	126	142	170	179	215
20	112	121	140	172	202	230
21	90	94	116	156	172	204
22	95	107	137	178	178	225
23	104	115	135	171	181	223
24	122	119	133	170	194	233
25	196	211	206	230	258	297

TABLE Nº A3
TEST DATA - RUN Nº 3
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= 150 °F	T= 165 °F
1	324	329	330	332	332	
2	337	341	347	350	351	
3	313	333	345	363	363	
4	384	393	396	397	396	
5	334	340	342	344	346	
6	320	336	341	349	351	
7	329	342	347	354	351	
8	262	271	272	274	278	
9	338	339	345	347	353	
10	345	362	368	375	377	
11	353	367	366	368	372	
12	279	291	302	317	312	
13	250	277	298	326	330	
14	313	333	345	363	363	
15	346	359	367	380	384	
16	353	361	365	373	372	
17	233	254	281	314	318	
18	231	258	278	308	312	
19	236	267	286	317	328	
20	257	280	302	331	341	
21	232	260	280	294	308	
22	250	270	284	306	317	
23	251	273	296	321	327	
24	260	285	303	324	326	
25	316	332	342	349	357	

TABLE Nº A3
TEST DATA - RUN Nº 3
(CONTINUED)

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
26	122	134	155	190	211	282
27	94	115	148	199	220	248
28	134	155	185	228	247	313
29	150	162	194	230	265	297
30	293	289	275	292	310	339
31	233	252	283	315	384	393
32	174	167	163	187	206	242
33	168	165	168	186	197	221
34	158	163	192	225	248	291
35	183	184	198	242	273	316
36	218	217	223	243	264	305
37	178	183	207	240	267	312
38	173	181	210	239	265	307
39	166	168	198	229	258	296
40	322	247	247	290	323	328
41	335	313	318	324	341	346
42	210	212	230	253	270	292
43	257	268	258	274	285	301
44	344	220	200	248	272	302
45	307	315	312	321	340	345
46	293	289	275	292	310	339
47	328	251	257	290	338	335
48	275	308	309	324	353	368
49	306	290	270	291	311	332
50	293	301	295	295	295	326

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TABLE Nº A3

TEST DATA - RUN Nº 3

(CONTINUED)

T.C. Nº	T= 90 °F	T=105 °F	T=120 °F	T= 135 °F	T=150 °F	T= 165 °F
26	269	297	315	341	347	
27	295	302	314	323	329	
28	330	351	363	380	385	
29	326	346	360	376	383	
30	352	366	373	383	391	
31	403	410	407	411	414	
32	270	298	320	334	350	
33	243	276	302	339	350	
34	316	341	356	377	379	
35	337	354	359	360+	360+	
36	323	347	361	381	382	
37	332	357	369	387	389	
38	331	351	365	378	383	
39	324	343	357	375	380	
40	345	355	366	379	383	
41	353	355	361	373	378	
42	302	320	329	346	352	
43	312	324	333	340	349	
44	320	336	346	354	360+	
45	350	353	358	383	391	
46	352	366	373	363	363	
47	344	359	364	376	384	
48	371	374	377	386	390	
49	344	354	360+	360+	360+	
50	334	343	349	362	368	

TABLE N° A3
TEST DATA - RUN N° 3
(CONTINUED)

T.C. N°	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
51	253	266	247	271	283	297
52	291	258	265	259	270	290
53	332	310	291	294	305	313
54	130	150	160	169	178	189
55	106	137	135	141	150	155
56	—	—	—	—	—	—
57	124	148	153	160	170	180
58	131	157	163	174	184	196
59	128	155	160	170	177	190
60	183	215	246	270	295	324
61	185	202	230	253	273	296
62	165	193	216	233	250	270
63	218	320	355	390	418	440
64	384	314	343	378	409	430
65	230	265	305	353	390	418
66	223	278	303	335	367	387
67	205	255	274	295	320	342
68	185	235	256	282	310	336
69	274	295	330	384	427	473
70	260	280	305	337	367	392
71	260	282	332	384	415	480
72	299	314	350	387	367	444
73	313	358	338	424	455	475
74	265	320	334	423	449	468
75	286	345	406	440	469	485

TABLE Nº A3

TEST DATA - RUN Nº 3

(CONTINUED)

T.C. Nº	T= 90 °F	T=105 °F	T=120 °F	T=135 °F	T=150 °F	T=165 °F
51	308	319	327	343	352	—
52	300	314	325	343	349	—
53	322	333	339	356	363	—
54	187	183	185	187	188	190
55	132	136	138	147	148	147
56	—	—	—	—	—	—
57	166	166	167	174	175	175
58	188	185	185	190	190	190
59	180	176	176	182	184	184
60	342	324	326	325	323	323
61	317	318	315	314	312	311
62	277	270	265	265	265	265
63	435	430	424	420	420	420
64	425	415	410	407	407	407
65	426	421	413	410	407	408
66	382	372	370	364	365	366
67	335	327	326	323	325	325
68	340	332	330	325	325	326
69	487	484	475	464	466	—
70	397	400	394	392	390	390
71	495	487	480	476	475	474
72	456	445	445	430	429	430
73	467	460	456	448	448	448
74	465	447	445	436	436	436
75	470	463	461	452	452	457

TABLE Nº A3
TEST DATA - RUN Nº 3
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
76	290	334	335	423	452	477
77	286	330	378	420	450	470
78	290	319	345	382	418	436
79	258	291	338	412	477	506
80	280	323	358	411	446	470
81	274	311	349	400	431	456
82	277	317	366	435	475	507
83	269	313	370	435	488	512
84	233	252	283	315	384	393
85	222	253	297	366	479	470
86	235	247	269	307	361	384
87	332	342	340	350	370	385
88	365	391	407	439	458	485
89	303	333	360	381	398	425
90	297	283	290	313	331	358
91	361	304	325	372	419	423
92	299	283	297	329	384	392
93	328	367	402	434	457	483
94	285	314	331	356	380	399
95	290	277	281	297	314	339
96	341	358	391	442	471	513
97	225	252	273	297	330	350
98	332	351	389	440	472	504
99	314	343	377	419	442	474
100	182	231	282	327	364	418

TABLE Nº A3
TEST DATA - RUN Nº 3
(CONTINUED)

T.C. Nº	T=90 °F	T=105 °F	T=120 °F	T=135 °F	T=150 °F	T=165 °F
76	470	460	456	448	448	448
77	458	445	442	435	434	429
78	438	435	427	420	420	—
79	508	495	488	478	478	—
80	463	456	442	440	438	—
81	456	439	431	423	420	—
82	507	485	481	474	474	—
83	507	496	486	480	482	—
84	403	410	407	411	414	—
85	479	469	464	459	458	—
86	379	364	358	354	352	—
87	397	398	398	400	402	407
88	489	474	463	455	452	—
89	422	416	409	413	413	—
90	370	370	374	382	389	—
91	427	421	424	426	427	—
92	392	378	372	366	370	—
93	484	468	458	452	451	—
94	399	396	397	399	405	—
95	388	379	385	392	395	400
96	516	509	497	488	485	—
97	378	386	390	394	395	398
98	511	499	487	478	475	—
99	470	458	451	452	449	—
100	432	433	429	426	426	—

TABLE Nº A3

TEST DATA - RUN Nº 3

(CONTINUED)

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
101	313	330	366	403	436	469
102	280	304	354	411	453	484
103	290	311	373	423	455	494
104	279	288	329	378	444	463
105	134	163	218	302	389	421
106	137	163	216	279	358	387
107	172	203	249	327	387	323
108	167	184	226	285	346	453
109	263	289	340	383	422	443
110						
111						
112						
113						
114						
115						

TABLE Nº A3

TEST DATA - RUN Nº 3

(CONTINUED)

T.C. Nº	T= 90 °F	T=105 °F	T= 120 °F	T= 135 °F	T=150 °F	T=165 °F
101	467	468	460	462	459	
102	483	470	459	450	450	
103	499	483	476	468	467	
104	468	464	457	458	454	
105	417	404	400	394	396	
106	381	367	366	363	361	
107	462	463	458	455	457	
108	403	411	416	421	423	
109	442	427	420	418	418	
110						
111						
112						
113						
114						
115						

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TEST DATA - RUN Nº 5

TABLE Nº A4

TEST CONDITION: STABILIZATION - SYSTEM ENERGIZED

DATE 1-12-64 START 0745 HR. END 1000 HR.

COOLING AIR FLOW:

3" DIA. INLET 6.9 #/MIN., 2" DIA. INLET 1.5 #/MIN.

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
1	99	102	103	104	104	104
2	105	109	112	112	113	114
3	139	162	181	194	203	209
4	142	167	187	200	209	210
5	98	101	104	105	107	107
6	109	116	119	121	122	123
7	109	112	113	116	116	117
8	115	119	127	131	134	134
9	108	114	120	124	126	127
10	113	122	129	132	134	136
11	113	120	123	125	126	127
12	97	98	101	102	103	103
13	105	114	123	127	130	132
14	139	162	181	194	203	209
15	178	235	265	285	296	304
16	167	194	222	244	254	265
17	96	99	102	104	104	104
18	105	109	112	114	114	115
19	109	130	138	144	147	150
20	107	118	124	128	131	132
21	94	100	103	104	106	106
22	100	108	109	111	111	111
23	104	110	116	119	121	124
24	104	116	132	138	145	147
25	141	155	195	211	228	235

TABLE Nº A4

TEST DATA - RUN Nº 5

(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
1	105	106	106	104		
2	114	116	115	114		
3	214	215	217	217		
4	218	220	223	223		
5	107	108	110	108		
6	124	125	125	123		
7	119	120	119	119		
8	136	137	139	138		
9	128	130	130	130		
10	137	138	139	137		
11	129	130	130	130		
12	102	105	105	104		
13	133	135	135	134		
14	214	215	217	217		
15	310	313	318	318		
16	274	276	284	283		
17	106	107	107	106		
18	116	116	117	116		
19	152	154	154	152		
20	132	134	134	133		
21	107	107	109	108		
22	108	110	110	108		
23	124	125	126	125		
24	149	150	152	151		
25	240	243	245	243		

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
26	111	124	132	138	142	144
27	100	102	105	107	108	110
28	122	136	145	151	155	158
29	130	169	184	195	202	206
30	175	234	284	318	339	355
31	213	228	238	244	250	252
32	118	129	167	181	195	199
33	123	135	154	166	173	179
34	133	163	177	186	193	199
35	135	146	170	195	211	218
36	145	184	215	236	250	258
37	139	173	193	204	210	215
38	140	159	177	190	200	205
39	135	169	184	195	202	206
40	177	274	316	342	360	366
41	182	246	307	353	373	390
42	134	191	220	237	252	263
43	135	172	245	273	311	322
44	165	331	362	382	385	390
45	169	223	281	329	353	368
46	175	234	284	318	339	355
47	180	287	334	360	375	386
48	188	215	252	284	302	322
49	159	185	269	303	348	360
50	165	211	257	302	328	347

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
26	146	148	148	148		
27	109	111	111	110		
28	161	162	162	162		
29	210	212	212	210		
30	368	373	377	377		
31	254	257	258	259		
32	203	205	208	208		
33	182	184	185	186		
34	201	201	206	200		
35	224	227	231	230		
36	266	270	272	272		
37	220	222	225	223		
38	212	215	219	218		
39	210	212	212	210		
40	377	374	380	375		
41	405	411	419	418		
42	272	272	274	273		
43	333	338	344	342		
44	391	392	390	387		
45	392	398	400	401		
46	368	373	377	377		
47	392	390	394	388		
48	338	345	356	358		
49	373	377	381	384		
50	368	375	382	381		

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
51	147	195	232	266	291	304
52	139	239	302	332	350	359
53	159	228	295	344	368	389
54	141	145	148	150	150	150
55	123	125	125	127	127	127
56	284	292	296	304	307	309
57	137	142	144	145	145	145
58	144	150	150	152	154	154
59	142	147	149	150	150	150
60	183	186	194	197	202	203
61	187	190	195	199	203	204
62	169	174	177	180	182	183
63	270	277	287	294	300	300
64	260	362	282	283	287	289
65	223	230	243	250	256	258
66	224	230	237	242	248	248
67	209	215	220	225	227	229
68	188	193	200	204	206	207
69	259	271	285	300	303	312
70	241	247	257	262	266	268
71	235	240	260	272	283	288
72	297	300	310	315	322	322
73	312	312	322	329	332	335
74	260	263	277	283	290	292
75	304	306	313	318	324	327

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 90 °F	T= 165 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
51	320	326	333	336		
52	372	374	376	372		
53	404	410	417	419		
54	150	151	152	153		
55	126	127	130	131		
56	307	313	314	313		
57	145	145	147	148		
58	153	154	155	157		
59	150	150	151	152		
60	205	206	208	208		
61	205	206	208	209		
62	183	184	185	186		
63	301	304	309	308		
64	290	292	296	296		
65	260	261	265	266		
66	250	250	254	254		
67	230	230	232	232		
68	210	210	210	212		
69	314	318	319	320		
70	273	272	277	278		
71	290	292	296	296		
72	325	325	330	330		
73	336	337	343	343		
74	294	294	300	300		
75	326	330	337	330		

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TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
76	278	288	301	310	318	320
77	280	287	300	309	315	317
78	284	293	301	304	309	311
79	222	238	260	271	283	289
80	270	280	291	296	299	305
81	268	277	284	291	295	296
82	243	258	279	290	297	301
83	258	269	285	293	299	301
84	213	228	238	244	250	252
85	195	212	225	235	243	246
86	233	233	238	240	239	239
87	215	246	312	338	—	—
88	346	349	362	369	375	376
89	268	276	294	313	325	332
90	196	244	290	314	332	339
91	221	331	372	388	401	406
92	256	260	264	274	274	277
93	312	322	335	344	351	354
94	202	222	262	294	318	336
95	212	240	275	294	—	303
96	325	327	338	343	352	357
97	190	205	229	240	—	255
98	335	336	339	347	298	358
99	303	306	317	321	324	331
100	204	207	212	217	220	223

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T=120 °F	T= 135 °F	T= °F	T= °F
76	324	325	332	330		
77	320	322	327	327		
78	314	313	317	321		
79	291	293	301	295		
80	303	306	313	311		
81	301	300	305	304		
82	306	311	313	315		
83	305	309	313	310		
84	254	257	258	259		
85	254	253	256	255		
86	241	242	248	245		
87	—	—	—	—		
88	378	379	386	390		
89	343	347	353	352		
90	352	354	359	358		
91	409	409	410	411		
92	278	284	284	289		
93	356	360	365	365		
94	349	356	362	363		
95	319	322	328	328		
96	356	358	368	370		
97	260	262	265	264		
98	357	357	362	365		
99	329	332	341	337		
100	221	221	226	221		

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
101	294	303	311	323	327	330
102	267	271	280	291	294	295
103	260	269	287	296	303	309
104	231	251	275	290	298	304
105	144	145	148	151	151	152
106	151	151	152	154	154	155
107	169	178	187	200	200	206
108	163	169	177	183	185	189
109	250	265	272	280	287	287
110						
111						
112						
113						
114						
115						

TABLE Nº A4
TEST DATA - RUN Nº 5
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
101	332	334	340	329		
102	297	301	306	301		
103	310	315	320	317		
104	307	305	311	311		
105	152	156	156	155		
106	156	157	158	159		
107	205	205	212	208		
108	190	190	198	194		
109	287	294	297	296		
110						
111						
112						
113						
114						
115						

TEST DATA - RUN N° 8

TABLE N° A5

TEST CONDITION: STABILIZATION - SYSTEM ENERGIZED

DATE 1-13-64 START 0030 HR. END 0245 HR.

COOLING AIR FLOW:

3" DIA. INLET 7.5 #/MIN., 2" DIA. INLET 1.5 #/MIN.

T.C. N°	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
1	84	85	86	86	85	86
2	89	93	94	94	94	96
3	144	161	180	191	197	201
4	143	159	170	180	185	187
5	88	87	88	88	88	88
6	90	99	101	103	103	103
7	91	96	96	97	98	98
8	102	105	109	110	112	113
9	98	101	104	106	107	108
10	102	107	111	114	115	116
11	100	103	107	107	108	108
12	83	83	84	84	84	84
13	96	103	106	109	110	111
14	144	161	180	191	197	201
15	179	219	243	260	271	274
16	171	191	205	221	229	235
17	85	85	86	86	87	87
18	84	94	95	95	96	96
19	100	114	119	121	123	124
20	95	103	108	110	110	111
21	83	86	86	86	87	86
22	82	89	89	89	89	90
23	94	97	98	100	100	101
24	100	112	117	120	123	123
25	148	174	191	202	210	215

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
1	87	84	86	88		
2	96	95	95	97		
3	202	208	207	208		
4	188	191	193	192		
5	88	88	88	89		
6	104	103	104	105		
7	98	97	99	99		
8	112	113	114	115		
9	109	108	110	110		
10	117	117	117	118		
11	109	107	109	109		
12	83	83	84	84		
13	111	111	111	113		
14	202	208	207	208		
15	281	283	281	281		
16	233	242	243	244		
17	86	86	88	88		
18	96	96	96	98		
19	124	125	125	126		
20	112	112	113	113		
21	87	86	87	87		
22	90	89	90	91		
23	101	101	102	104		
24	125	125	125	125		
25	216	218	220	221		

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TABLE Nº A5

TEST DATA - RUN Nº 8

(CONTINUED)

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
26	104	111	116	120	121	123
27	87	87	89	89	89	89
28	111	119	124	128	129	130
29	121	142	155	161	164	166
30	190	240	273	296	310	322
31	202	208	213	216	220	221
32	120	139	156	165	172	174
33	124	128	138	148	151	154
34	121	148	158	164	167	168
35	136	155	170	179	187	190
36	150	180	199	211	219	229
37	139	163	178	190	194	198
38	140	150	163	172	177	181
39	122	147	164	170	173	175
40	178	261	286	304	312	221
41	213	238	275	300	319	328
42	139	182	202	213	223	232
43	170	218	249	267	281	290
44	170	218	249	267	281	290
45	205	240	281	311	333	344
46	190	240	273	296	310	322
47	165	265	295	311	321	327
48	219	227	259	288	303	317
49	187	245	281	300	315	324
50	208	218	258	291	315	325

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
26	124	123	125	125		
27	90	89	91	91		
28	131	131	132	133		
29	169	169	169	166		
30	331	331	332	338		
31	221	227	228	227		
32	176	177	177	177		
33	155	157	157	158		
34	170	170	170	171		
35	194	195	195	196		
36	229	234	231	236		
37	200	204	202	206		
38	182	185	186	186		
39	179	178	179	180		
40	324	328	327	327		
41	338	341	347	348		
42	235	238	235	240		
43	297	299	300	300		
44	297	299	300	300		
45	352	360	361	361		
46	331	331	332	338		
47	334	336	335	336		
48	322	329	329	335		
49	331	333	335	335		
50	332	340	344	343		

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
51	180	204	232	254	271	281
52	145	233	278	305	317	323
53	184	237	287	318	337	349
54	121	121	121	121	120	121
55	92	92	90	92	93	94
56	278	274	278	288	285	288
57	110	110	108	110	110	110
58	119	119	116	117	118	118
59	116	115	113	115	115	116
60	170	172	175	178	179	180
61	175	174	175	176	177	178
62	149	150	150	151	150	151
63	269	272	278	280	282	283
64	252	260	265	268	270	272
65	216	222	228	233	235	236
66	206	210	213	218	222	222
67	185	186	188	192	192	190
68	167	170	171	175	176	176
69	275	275	281	291	293	297
70	235	237	241	245	248	249
71	227	235	245	254	260	262
72	294	293	293	300	304	302
73	304	308	311	317	316	316
74	266	270	275	280	281	281
75	290	295	298	304	306	306

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
51	293	297	299	303		
52	325	326	330	329		
53	356	363	365	369		
54	122	122	122	125		
55	91	90	94	95		
56	288	293	293	293		
57	110	110	110	112		
58	119	117	120	121		
59	115	114	115	118		
60	179	181	180	180		
61	180	180	180	180		
62	155	153	152	155		
63	284	286	284	285		
64	275	274	274	275		
65	239	240	239	240		
66	222	222	222	225		
67	193	192	192	193		
68	177	177	177	180		
69	302	306	302	304		
70	249	250	250	250		
71	265	268	268	270		
72	304	305	303	305		
73	320	318	317	320		
74	285	284	284	285		
75	308	308	308	310		

TABLE Nº A5

TEST DATA - RUN Nº 8

(CONTINUED)

T.C. Nº	T=0 °F	T=15 °F	T=30 °F	T=45 °F	T=60 °F	T=75 °F
76	270	278	284	292	295	295
77	270	278	284	288	293	294
78	276	279	284	288	290	291
79	223	232	241	253	259	266
80	261	267	274	282	287	290
81	260	262	270	280	281	282
82	243	255	269	282	287	287
83	255	262	269	281	282	287
84	202	208	213	216	220	221
85	191	207	214	228	233	233
86	222	226	224	225	230	228
87	236	274	305	328	346	356
88	338	344	352	363	362	363
89	287	277	294	308	322	324
90	210	242	271	289	304	308
91	213	306	328	342	348	352
92	256	258	260	261	268	261
93	305	316	326	333	336	336
94	235	234	259	286	305	316
95	223	247	265	278	288	294
96	317	319	326	334	342	344
97	185	198	209	217	224	228
98	324	324	329	338	338	341
99	292	297	303	310	312	313
100	191	195	199	204	208	206

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
76	299	299	298	300		
77	296	295	295	297		
78	293	293	294	293		
79	268	270	267	266		
80	290	292	289	289		
81	282	283	282	285		
82	290	293	292	293		
83	287	289	289	286		
84	221	227	228	227		
85	238	238	239	240		
86	232	230	232	232		
87	368	369	372	373		
88	365	366	366	367		
89	336	338	338	340		
90	313	314	318	320		
91	352	355	355	355		
92	271	267	267	267		
93	339	341	342	339		
94	323	332	335	335		
95	298	300	301	302		
96	345	349	344	344		
97	230	231	232	232		
98	341	343	345	347		
99	312	316	312	313		
100	210	208	207	207		

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 0 °F	T= 15 °F	T= 30 °F	T= 45 °F	T= 60 °F	T= 75 °F
101	285	291	300	310	313	315
102	257	263	267	273	279	278
103	257	270	281	289	294	293
104	231	243	259	270	277	280
105	132	130	132	133	134	135
106	137	135	135	137	137	137
107	161	165	169	174	177	178
108	159	162	165	169	170	170
109	398	400	406	410	410	410
110						
111						
112						
113						
114						
115						

TABLE Nº A5
TEST DATA - RUN Nº 8
(CONTINUED)

T.C. Nº	T= 90 °F	T= 105 °F	T= 120 °F	T= 135 °F	T= °F	T= °F
101	315	321	322	320.		
102	278	279	282	279		
103	295	296	297	299		
104	283	287	287	285		
105	135	135	137	136		
106	137	135	137	138		
107	179	179	181	181		
108	171	172	173	173		
109	405	410	410	412		
110						
111						
112						
113						
114						
115						

TABLE Nº A6

STABILIZED TEMPERATURE
(EMERGENCY CONDITION)

AIR FLOW:
3" DIA. INLET .90#/MIN. , AIR TEMP. 80°F
2" DIA. INLET .60#/MIN. , AIR TEMP. 120°F

T.C. Nº	TEMP. (°F) @ 2230 HRS.	TEMP. (°F) @ 2245 HRS.	T.C. Nº	TEMP. (°F) @ 2230 HRS.	TEMP. (°F) @ 2245 HRS.
1	215	219	16	293	296
2	227	230	17	208	216
3	295	295	18	205	211
4	300	306	19	231	233
5	198	215	20	233	234
6	310	310	21	204	204
7	212	228	22	194	205
8	199	210	23	220	226
9	226	236	24	231	231
10	245	259	25	286	282
11	236	252	26	250	252
12	208	216	27	192	215
13	235	234	28	295	297
14	295	295	29	314	321
15	326	326	30	368	369

TABLE Nº A6
(CONTINUED)

T.C. Nº	TEMP.(°F) @ 2230 HRS.	TEMP.(°F) @ 2245 HRS.	T.C. Nº	TEMP.(°F) @ 2230 HRS.	TEMP.(°F) @ 2245 HRS.
31	358	351	51	365	365
32	292	290	52	356	357
33	295	294	53	370	371
34	306	311	54	220	218
35	311	311	55	158	158
36	331	333	56	413	414
37	320	323	57	200	200
38	326	329	58	222	221
39	314	321	59	211	210
40	366	370	60	344	340
41	384	388	61	336	335
42	347	352	62	296	294
43	357	358	63	411	413
44	357	358	64	400	400
45	380	383	65	390	397
46	368	369	66	368	370
47	363	366	67	342	342
48	384	386	68	343	343
49	364	365	69	448	447
50	375	376	70	380	380

TABLE Nº A6
(CONTINUED)

T.C. Nº	TEMP.(°F) @ 2230 HRS.	TEMP.(°F) @ 2245 HRS.	T.C. Nº	TEMP.(°F) @ 2230 HRS.	TEMP.(°F) @ 2245 HRS.
71	412	415	91	440	448
72	425	425	92	338	340
73	436	436	93	447	450
74	435	436	94	397	401
75	439	440	95	351	349
76	440	442	96	453	454
77	421	422	97	320	330
78	413	414	98	445	445
79	410	418	99	403	406
80	420	425	100	456	459
81	412	415	101	409	410
82	429	436	102	406	413
83	427	436	103	429	433
84	358	351	104	390	396
85	376	380	105	292	307
86	309	311	106	261	279
87	—	—	107	340	359
88	450	452	108	328	336
89	410	411	109		
90	385	385	110		

TABLE N° A7

STABILIZED TEMPERATURE
(EMERGENCY CONDITION)

AIR FLOW:
3" DIA. INLET .90 #/MIN. , AIR TEMP. 45°F
2" DIA. INLET .60 #/MIN. , AIR TEMP. 80°F

T.C. N°	TEMP. (°F) @2000 HRS.	TEMP. (°F) @2015 HRS.	T.C. N°	TEMP. (°F) @2000 HRS.	TEMP. (°F) @2015 HRS.
1	189	189	16	282	281
2	205	206	17	203	206
3	279	278	18	197	197
4	291	291	19	225	222
5	196	196	20	225	228
6	205	208	21	195	194
7	212	212	22	186	186
8	188	186	23	213	213
9	214	215	24	225	225
10	241	243	25	275	275
11	237	238	26	245	243
12	202	200	27	193	193
13	226	225	28	284	285
14	279	278	29	312	311
15	315	312	30	353	357

TABLE Nº A7
(CONTINUED)

T.C. Nº	TEMP. (°F) @ 2000 HRS.	TEMP. (°F) @ 2015 HRS.	T.C. Nº	TEMP. (°F) @ 2000 HRS.	TEMP. (°F) @ 2015 HRS.
31	340	341	51	342	344
32	294	292	52	338	342
33	290	289	53	349	355
34	305	304	54	186	187
35	309	309	55	124	121
36	325	325	56	402	401
37	313	313	57	167	165
38	320	321	58	191	189
39	312	311	59	179	177
40	356	357	60	328	329
41	368	370	61	309	312
42	337	338	62	272	274
43	343	345	63	399	399
44	343	345	64	390	389
45	360	366	65	384	384
46	353	357	66	355	355
47	356	356	67	322	321
48	364	365	68	328	329
49	353	354	69	434	434
50	354	355	70	361	362

TABLE N° A7
(CONTINUED)

T.C. N°	TEMP. (°F) @ 2000 HRS.	TEMP. (°F) @ 2015 HRS.	T.C. N°	TEMP. (°F) @ 2000 HRS.	TEMP. (°F) @ 2015 HRS.
71	361	362	91	396	397
72	410	410	92	317	316
73	413	414	93	432	432
74	435	436	94	376	379
75	439	440	95	344	344
76	433	430	96	446	443
77	421	422	97	328	328
78	393	391	98	433	435
79	406	406	99	395	390
80	410	407	100	347	345
81	397	393	101	401	401
82	423	421	102	394	395
83	423	421	103	419	419
84	340	341	104	388	386
85	357	358	105	284	282
86	288	289	106	257	257
87	—	—	107	346	346
88	436	434	108	328	325
89	393	393	109		
90	366	370	110		

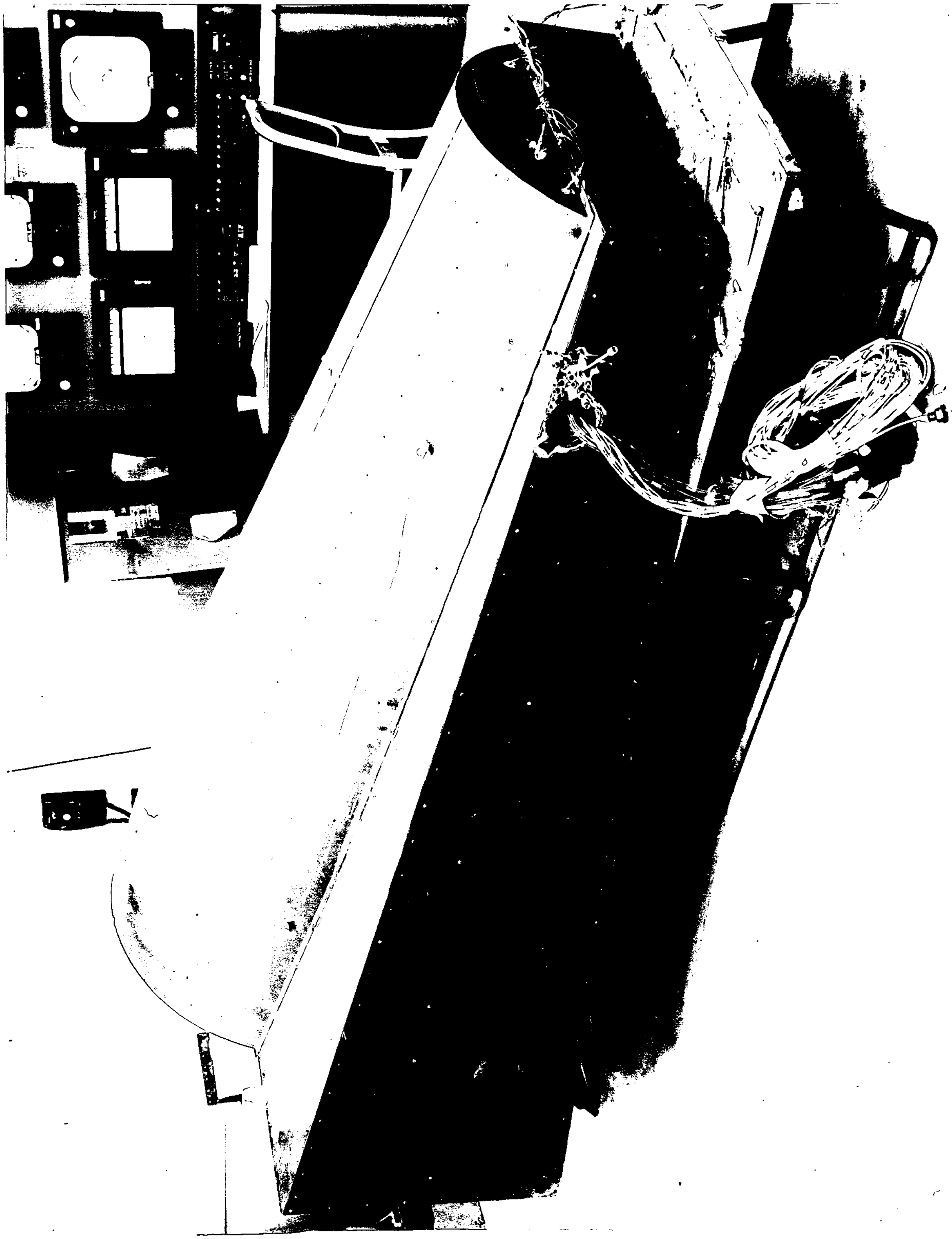

ILLUSTRATION NO. 1

Simulated Vehicle Section

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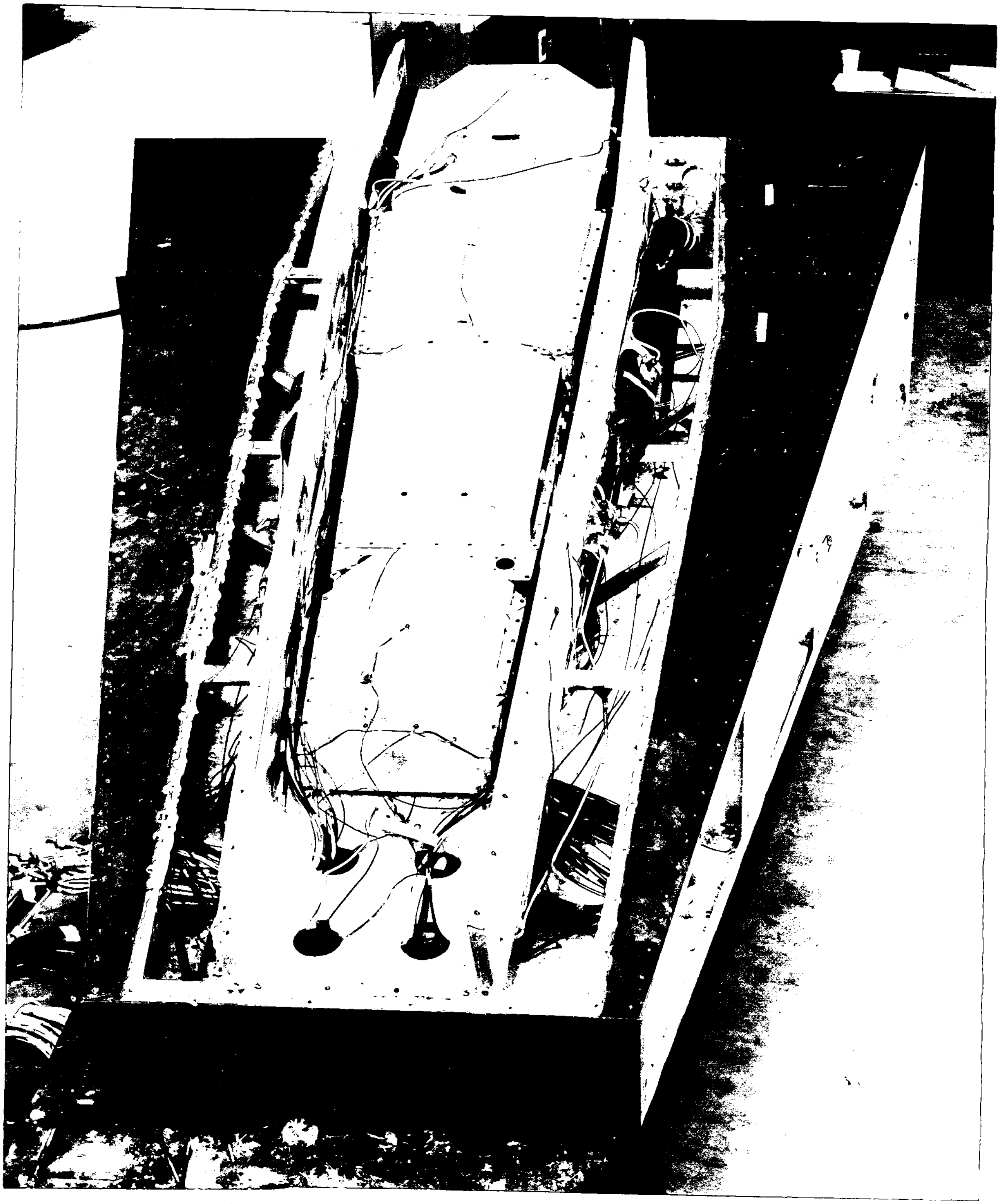

ILLUSTRATION NO. 2

Simulated Vehicle Section

Upper Compartment

ILLUSTRATION NO. 3

Inlet Cooling Air Manifold

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ILLUSTRATION NO. 4

Exhaust Cooling Air Manifold

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